Iron

His Royal Highness

[illegible]

Engraved by [illegible] for the [illegible]

KNIGHT & LACEY. LONDON. AUGUST 28, 1828

MECHANICS'

MAGAZINE.

VOLUME NINTH.

"It is a strange thing that in sea voyages, where there is nothing to be seen but sky and sea, men should make diaries; but in land travel, wherein so much is to be observed, for the most part they omit it; as if chance were fitter to be registered than observation:—let diaries therefore be brought in use."

LORD BACON.

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PREFACE

TO

VOLUME THE NINTH.

Science and Religion, so naturally fitted to aid and adorn each other, have had the misfortune of late to be frequently represented as in a state of irreconcileable hostility. The increasing taste of the public for mathematical and mechanical pursuits has, in a particular manner, been accused of weaning the minds of men from all higher and holier aims, and leading them to look for improvement and happiness through the cultivation of the intellect alone.* Groundless as these charges are, and gloomy the spirit by which they are dictated, it must, nevertheless, be confessed that they derive considerable countenance from the avowed principles of some of those who are found taking a foremost part in the diffusion of scientific knowledge. A sect of philosophers has sprung up in modern times, who do talk as if the Arts and Sciences were deserving of cultivation, in proportion only as they minister to the gratification of the senses, and to the supply of our temporal wants; as if we had neither hearts to be amended, nor minds to be exalted, nor any destiny awaiting us beyond that of "the beasts that perish." Man appears to be regarded by them as a mere producing and consuming animal; their only table of the law, is a table of weights and measures; feeling and sentiment they wholly discard as motives of human action; all, with them, is matter of cold and heartless calculation. But the disciples of this school of philosophy form, happily, but a small group in the midst of a crowd of labourers who throng the field of popular instruction. The view which they take of the arts and sciences, forms too, but a part of a general system; they are in *all* things

* Irving; *passim.*

equally contracted and worldly. What fanatics are to religion, these Utilitarians (as they call themselves) are to learning; and it is no more fair to take them as a sample of the class in which they happen to mingle, than it would be to condemn all religions on account of the follies of the Jumpers and Ranters. For ourselves, we may be permitted to observe, that so far are we from sharing in such doctrines, that we agree with an eloquent anonymous critic, in thinking that "it would be better that the world should be wholly without the inventions of art and the discoveries of science—without steam-engines and political economy,—than that it should want earnestness and goodness, kindly affections, generosity, piety, and truth."—(*Athenæum, No.* 19.) Aye, better far, that books of science and art, laboratories and lecture-rooms, Mechanics' Institutions and Mechanics' Magazines, should never have been heard of, than that a single benevolent heart should be frozen under their influence, a single lofty aspiration be crushed, a single rational and animating hope be extinguished, or a single eye be dimmed by looking through their medium at the power, the wisdom, and the beneficence of the Great Creator.

But what is there in the arts and sciences, viewed in themselves, which ought to justify the slightest apprehension of such results? The raving philippics which one eminent divine has launched forth against them cannot, perhaps, be better met than by quoting the calmer reasonings of another, of at least as high authority. "We say and hear so much," says the equally pious and learned Dr. Dwight, "concerning the insufficiency of these works to unfold the character of God, and the nature of genuine religion, that we are prone to consider them as almost uninstructive in moral things, and in a great measure useless to the promotion of piety. This, however, is a palpable and dangerous error. All who feel the spirit of the Gospel will rejoice in those works in which God rejoices; will find God everywhere in the works of his hands; and, passing beyond those second causes, which are merely instruments of his agency, will see everywhere displayed the finger and character of the Divine workman."

We hold it, indeed, to be impossible that any rational being can enter on contemplations like these,—no matter what the

particular spirit which he feels may be, provided always it is not an "Utilitarian" spirit,—without making precisely the same discoveries. For, linger as a man may among physical causes, attach to them all the importance he can,—he will never, while he takes right reason and right feeling for his guides, be able to find a permanent resting-place among them. His conclusions must still point onwards. Even one of the most sceptical writers of modern times—one whom it is always safer to quote than name—has said, "*Man cannot make principles; he can only discover them; and he must needs look through the discovery to the Author.*"

Honoured as we have been, by being made, to a greater extent than most other Journalists, the organs of this prevailing attachment to mathematical and mechanical studies, we wish it were only as easy to show that we have deserved well of our patrons, as it is certain that the taste by which they are animated is pure and salutary. We can conscientiously aver, however, that during the progress of this our Ninth Volume, there has been no relaxation of exertion on our parts, to minister to the instruction and entertainment of our readers; but that, on the contrary, greater efforts than ever have been made to meet their various wants and wishes, and to embody within our pages everything of importance and novelty connected with those interests to which they are peculiarly devoted. The marks of a corresponding improvement are not, we trust, altogether wanting; the wine, it is to be hoped, bears better evidence than any label which can be affixed to it, that it has improved by age.

We have again to perform the agreeable task of tendering our thanks to a numerous and most respectable list of Correspondents, for much able assistance received from them in the prosecution of our labours. We observe, with pleasure, several new auxiliaries among them, and the more so, that many of our first are still our most zealous supporters. The highest reward, perhaps, to which we can aspire, is to be able at all times to say, with as much truth as we do now, that our fastest friends are those who have watched us longest, and who know us best.

29th July, 1828.

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Price Eight Shillings.

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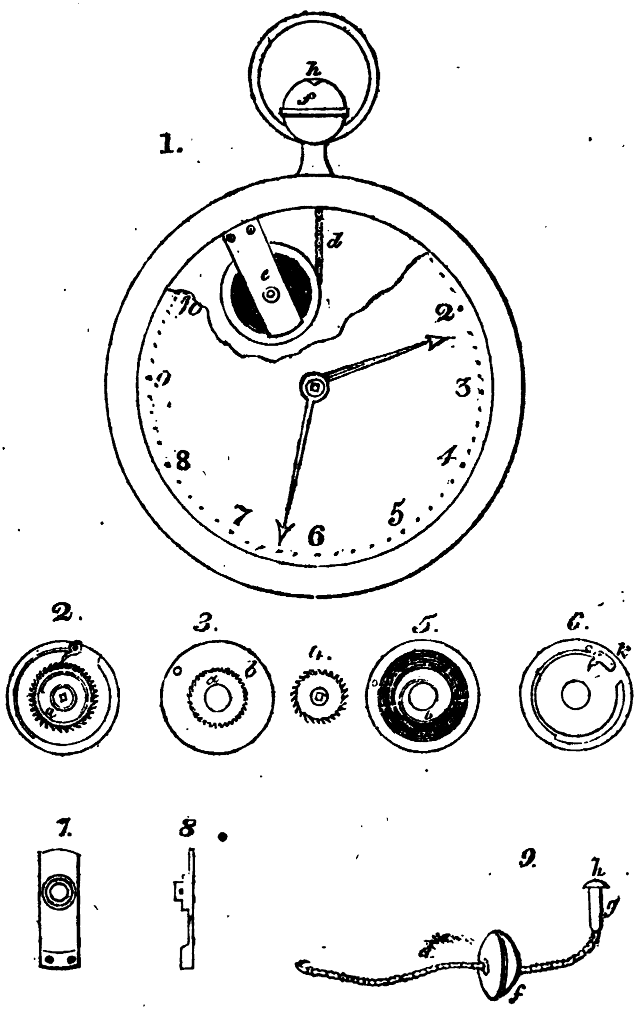
No. 236.] SATURDAY, MARCH 1, 1828. [Price 3d.

"It is below the dignity of a reasonable being to owe that strength to necessity, which ought always to act at the call of choice; or to need any other motive to industry, than the desire of performing one's duty."—Dr. Johnson.

BERROLLAS'S KEYLESS WATCH OR CLOCK.



BERROLLAS'S KEYLESS WATCH OR CLOCK.

It has long been a desideratum among horologists to wind up a watch or clock without a detached key; to do so by a fusee, they have always considered impracticable; but in the case of watches with going barrels, it has been supposed that such an improvement might be effected. From the specification of a patent just enrolled (Feb. 28, 1828) by Mr. Joseph Anthony Berrollas, it appears that he has succeeded in devising a winding-up action, which is applicable to all descriptions of horological movements, *whether going barrels, or fusees.* The following is Mr. Berrollas's specification of this important improvement:—

"The first mover, or power, in most horological works, is obtained either by the action of a weight, or spring. In pocket-watches, the power is obtained by a spring called the main spring, which is enclosed in a box called the barrel. Now there are two distinct ways of applying the power of this main spring to the first wheel of a watch: one of them consists in the intervention or agency of a fusee, which is put upon the first wheel; in the other, the first wheel is put upon the barrel itself, that contains the spring—which arrangement is distinguished from that having a fusee by the term 'going barrel.' Watches having going barrels, are wound up by turning round the barrel arbors: and watches having fusees, by the fusee arbors.

"My invention consists in a new mechanical arrangement, applicable to the winding up of horological works. First, as respects what is termed a going barrel, the following are the contrivances that I have invented as applicable thereto:—

"Figure 1 represents a watch with a going barrel, to which my invention is applied; in which figure, a part of the dial-plate is represented as broken away for showing the novel parts, the operation of which will be understood by first describing the separate figures 2, 3, 4, 5, 6, 7, 8, 9, all the same letters of reference in which refer to similar parts. Figure 2 is the barrel ratchet with its click and spring, which keeps the maintaining power up: this ratchet is put on the barrel arbor, which is squared, and the plate is sunk in which it lays; it is on the side of that part of the plate under the dial: this barrel ratchet is sunk, or turned out, as far as the teeth, to receive another ratchet with its click and spring, shown at *a*, figure 3, which I call the recoiling ratchet. This recoiling ratchet is fastened on to the barrel pulley 6; the upper side of this barrel pulley is sunk to receive a spring *c*, shown in figures 1 and 5, which is the recoiling spring; on the edge of the barrel pulley there is a groove to receive a chain *d*, shown at figures 1 and 9, which is hooked on a pin in the said groove. Figures 7 and 8 give two views of the stud which keeps the barrel pulley steady close to the barrel ratchet; the centre of this stud is round, and the centre of the recoiling spring is hooked on; the other end of the recoiling spring is hooked on the barrel pulley. Figures 1 and 9 show the impendent, made of the same metal as the case; it turns freely on a piece of steel *g*, figure 9: this steel arbor has a small knob on one end *h*, shown at figures 1 and 9, to prevent the impendent from slipping off; on the other end it is split to receive the end of the chain, which is pinned on; the pendent of the case is perforated, through which the chain passes. I shall next describe the manner in which it is to operate, and how it is to be put on the winding-up arbor. When the barrel ratchet before mentioned is put on the square arbor, the recoiling spring is put on the barrel pulley, and placed over the barrel ratchet, so as to act on its click: the chain, which is not longer than to produce one revolution of the pulley, is put through the pendent, and hooked on to the pulley. The stud is then hooked on the recoiling spring; by this stud the recoiling spring is set up one turn, more or less, and the stud is screwed on the plate. To wind up the watch, the impendent is drawn from the pendent as far as the chain will permit it; the recoiling spring will bring the impendent back again to the pendent; and this operation is repeated, till the impendent remains on the pendent, and cannot be more drawn from it, which indicates that the main spring is wound up.

"When the works are to be wound up by a fusee arbor, the ratchet which keeps up the maintaining power is on the fusee itself; the fusee arbor, squared, is on the same side of the plate as the going barrel under the dial. The recoiling ratchet, fig. 4, is put on the fusee arbor; its click and spring are on the barrel pulley, fig. 6. Here it is to be observed, that when any works are to be wound up by a fusee, the fusee, with

the first wheel and its arbor, returns back again, which is not the case with a going barrel. *h* is the relieving click, which has a double action: first, it acts as the recoiling click, by its action in the ratchet; secondly, it acts as a reliever of the said click: it is planted on the under side of the barrel pulley, fig. 6, with its spring, and must be made in the form shown in the drawing. That part which is near the edge of the barrel pulley has a small pin, which pin goes through an aperture of the barrel pulley into the groove where the chain lies. When the works are wound up, the impendent rests upon the pendent, and the chain lays round the pulley, which is the same as with the going barrel. The pin of the relieving click, which goes into the groove of the barrel pulley, receives a pressure from the chain; it brings the click part out of the ratchet, and gives free action to the ratchet on the fusee arbor, to return back again without any drag or incumbrance of the click. *l*, fig. 1, is the finger touch; it is made of gold, or some metal which will not rust. By referring to the drawing, it will be seen that it is a kind of cup with a milled edge, and the minute hand is fastened to it: when the hands are to be set, a slight pressure with the end of the fore-finger is required to turn the hands. In case it is desired to have a watch or clock wound up in one pull, the multiplying of the turns of the chain round the barrel pulley will have that effect. The foregoing account is a full description of the general principles of my invention, applicable to pocket watches; the only alteration it will require for clocks, is in the chain, and the impendent, which must depend on the clock case."

"The points," Mr. B. concludes, "upon which I ground my right of exclusive privilege to the above inventions and improvement under my aforesaid hereinbefore in part recited patent, are the new combination of mechanism which I have produced in the simple, easy, and convenient way of winding up or setting the hands of horological works or movements, by the combined operation of the recoiling ratchet, its click, and spring, the recoiling spring, the barrel pulley, the relieving click, the stud, the impendent with its chain, and the finger touch. But I hereby distinctly disclaim any exclusive right, benefit, or advantage, to the individual parts hereinbefore described, which I claim only in their combined and collective capacity; my present patent being for a new mechanical arrangement and combination of parts already well known, but now applied by me to the production of a new purpose and effect."

FIRE ESCAPES.

Sir,—Two more fatal fires have taken place; human lives have again been lost; and several of our fellow-beings severely injured. I say nothing of the loss of property; for what are goods compared with life?

As one or two ideas of assisting individuals to escape from a house on fire have occurred to me, and which I am not aware have ever been resorted to, I beg, if you approve of them, to make them public through the medium of your columns.

The first I shall describe, and which I think the most important, is to break through the party-wall from the adjoining houses, to any floor or apartment in a house on fire, where any unfortunate individual may happen to be. A hole a little more than one foot square would be sufficient. Such a hole might be made in much less time than any ladder could be procured. There are but few party-walls in London, from second floors and upwards, through which, with proper tools, any bricklayer, carpenter, labourer, or indeed almost any working mechanic or fireman, might not form a sufficient *hole* for persons to escape, in *five* minutes. Such holes need not in the least endanger the adjoining houses; they may indeed instantly be filled up, after the persons have escaped, with the bricks taken out.

The necessary tools for such work might be kept in every watch-box. These, to prevent their being used for improper purposes, should be frequently examined: their appearance would always indicate if they had been recently used. Again, unfortunate individuals thus in danger, might frequently, by the assistance of a *poker*, greatly contribute to form the *hole of escape* for themselves.

The second method of rendering assistance which I shall describe, depends upon the nearness of the windows of the house on fire to

those of the adjoining houses. These are frequently so near, that a person at the window of one house might reach the hand of a person at a window in the other. In such cases, children might be handed from the one to the other; and where the distance is greater, an almost instant communication between the windows might be formed with ropes. If the end of a rope were tied to the middle of a stick six or seven feet long, such a stick might be reached by an individual to the one in danger, and then drawn in at the window, and placed upright on the inside of the window, and on that side of it adjoining the window from which it was received. The rope being then pulled tight, that end of it would be perfectly secure, by the lower end of the stick resting against the back of the window, or the part immediately below the window, within the room, and the upper end resting against the top sash. In a similar way, the rope might be secured within the window of the adjoining house. This, without any thing more, would be a sufficient escape for many persons. For others, a second rope with a sling at the end might be handed; this being put over the head and under the arms, the person about to escape might, by taking hold of the fixed rope, be assisted to pass between the windows, with greater confidence; or a light *foot* board might be suspended from the fixed rope, about four feet below it, on which, by holding by the fixed rope, a person might walk.

The method of breaking a *hole* through the party-wall, I repeat, I think of the most importance; for there is no person, however timid, but who could thus escape.

Since writing the above, I have been informed that had there been a trap-door to the roof in the house where the first of the fires occurred, all the persons lost and injured might have escaped. An opening in that case might have been made through the roof and ceiling to an attic room in five minutes; but still, I think, that would not have been so well as a *hole of escape* through the party-wall, which may be made in as short a time, and through which the exit for all descriptions of persons would be both quicker and safer.

The progress of fires is greatly accelerated by throwing open doors and windows. When a staircase is on fire, all doors communicating with it, in which any person is, should be closed; and if any hope of escape through the party-wall could be given, the windows should also be shut.

It appears to me that this is a subject to which you would do well to solicit your correspondents to turn their attention.* Perhaps there may be some who may have opportunities of trying experiments in breaking a hole in walls of different thicknesses, sufficiently large for a person to get through. The result of such experiments, with a description of the tools made use of, would be desirable.

I am, &c.

J. S. S.

ON CERTAIN FLINTS FOUND IN THE MIDLAND COUNTIES; WITH AN INQUIRY INTO THE ORIGIN OF SILICEOUS BODIES IN GENERAL.

BY MR. EDWARD GRIMES.

The first part of the following paper appeared in one of the Edinburgh journals of science some time ago; but it was published without consulting the author, and is now corrected and added to.

There are, in Warwickshire and the neighbouring counties, "certain flints, bearing marks of fracture, and by some process having been reunited." They are the common black and grey flints of the chalk, and are abundantly found in the gravel and vegetable soil. They have been traced from about ten miles north of Leicester, to Brandon, a village about ten miles south of Rugby, that is, comprising a distance of about forty miles north and south; and they, probably, extend much further; also, from about

* Two other communications on this subject, from Mr. Hudson and P., in our next.—EDIT.

Naseby, Northampton (wherever there is gravel), and Daventry, &c., to about fourteen miles eastward.

They appear to have been broken while in the matrix by some convulsion; which fracture has been "flat," and not conchoidal: it is also remarkable that most of them have lost an intermedial portion of their substance, as if they had undergone considerable attrition; and the two parts have been so exactly adapted, and so firmly re-cemented, to each other (though pushed out of their original position), that on a transverse fracture, the line of adjunction is sometimes hardly perceptible; it is occasionally indicated by a white mark.

Most of these flints have lost the angles which accrued to them by fracture, either from rolling, or decomposition, though some few have been found perfect.

They do not appear to have been separated in a soft state, for they bear no symptoms of compression: nor have they any appearance of having been acted upon by fire.

The principal line of dislocation, it is to be observed, is generally longitudinal, though they have often had many cracks besides, in all directions, as is shown by a very perceptible line or ridge upon the surface—such as would be exhibited in a piece of wax, if cut through with a hot knife, and immediately reclosed.

Having taken some pains to examine into these phenomena, no doubt is left on my mind as to the immediate cause of both the one and the other—their "fracture," and their "re-union." The immediate cause of their fracture is quite evident—namely, a "natural convulsion." The mode by which they have been re-united, I will endeavour to account for.

There are three distinct kinds of chalk flints in these counties, which, like those in all other places, coming properly under the denomination of "flints," have some central portion more opaque than the rest, indicating a nucleus of perhaps organic matter, but without any distinct outline. Parts of shells are often enveloped in them, which occasionally retain their calcareous character, sometimes with a fibrous, sometimes with a spalture, structure. They are all porous or vesicular, but in different degrees. The most compact is the "black flint," which is also the most brittle: those which appear to be the most porous or vesicular, are the "translucent grey flints;" and the most "cohesive" are of a muddy, yellowish, reddish grey, slightly, if at all, translucent, and they generally exhibit more impressions and remains of shells. They all contain either water, or some other fluid perhaps more volatile: on breaking the stone in a strong transmitted or reflected light, it may be seen, by a quick application of the eye, exuding from the vesicles. This fluid will generally deposit a slight film, resembling the effect of gum-water, which is not affected by acids, but is easily removed by the finger, or even by the action of water poured upon it.

Upon the flaws of flints that have been rent by exposure, are to be found little stellular concretions, evidently produced in the same way: these, when the exudation has been sufficient, take a more decided character—becoming minute fibrous crystals, cruciform, or divergent, or rose-like.

This same substance is often to be found in much larger quantities, circularly arranged round a centre, which bears the appearance of a small orifice: it is often of the size and thickness of a wafer; sometimes extends to an inch or two, when more than one join. These three latter adhere more firmly to the stone; the flakes generally split when the stone is divided by a blow, one half adhering to each side; and they exhibit the same kind of ragged, stringy, appearance, so often perceptible in a "black" flint, particularly when fractured.

There can hardly be any stage between this and the actual re-cementation of the two parts by means of this exudation. It seems probable that the whiteness of the solid substance may be caused by a

degree of decomposition while in a soft state, from the admission of a certain portion of atmospheric air, which those bodies, now called flints, were not liable to at their first formation: and where this white line is of any considerable thickness, as it often is to a quarter of an inch, or more, it seems probable that the interstice has been filled up by the abraded particles produced by the friction which it must have been subjected to, or by the chalk falling in between.

To have consolidated the uniting fluid, it is possible that some portion of atmospheric air may have been admitted at the time of their fracture, and yet not sufficient to allow of the escape of any great portion in a gaseous state.

We find very compact flints and hollow balls of agate to contain crystals of quartz in the interior; and, occasionally, flints which appear to have rent in the heart by the effect of contraction when drying, have filled up with extraneous siliceous matter, none of the rents reaching to the surface. Similar effects of drying are to be observed in balls of lime and iron-stone, which sometimes remain vacant, and in others fill up with calcareous matter, or pyrites.

I shall presently endeavour to account for these nodules of lime, as well as of the flint.

It seems that the fluid abovementioned as being contained in the flints, in a great measure disappears when they are long exposed to the atmosphere; though not entirely, for I have observed it in flints that had been exposed for a considerable length of time, and after baking them too for some hours: the absorption or dissipation of any portion of it I can in no wise account for, if the stones are only "vesicular," and not "porous." I never could induce them to re-imbibe any moisture by soaking them in water. They may, probably, be capable of a degree of contraction and expansion, as they are certainly elastic.

I shall notice here a common effect of the atmosphere upon chalk flints, which is curious and interesting:—When they have been long exposed, little white rings or spots appear upon their surface; after a time, pieces break out in the form of a crescent, with three edges,—the lower edge being perpendicular to the plane of the surface, so that a crescent-shaped hollow is left, the inner side of which forms a half cone with the apex truncated: these, of course, multiply; and the projecting parts falling into dust, if the stone exists long enough in an exposed situation, they are succeeded by others.* I would ask the chemist, when a flint decomposes, what does it first part with? it becomes white, opaque, and earthy, and perhaps, in the end, calcareous! yet, in bulk, it is nearly the same: it seems, then, that it loses that principle to which it is indebted for its cohesion, its compactness, and its transparency. The discovery of this principle would be important, and little doubt remains in my mind but it would lead to the discovery of the essential properties of flints—namely, a "siliceous fluid," or "gas;" for as no two bodies are more distinct in their properties than silex and carbonate of lime, and as one is accounted for by the presence of "carbonic acid gas," the other remains to be explained by the presence of "silicic acid gas."

Now, we find fossil shells, and geods, which we know to have contained animal matter, partly filled with crystals of various substances—for instance, lime, silex, carbon, bitumen, strontian, barytes, lead, fluor, pyrites, and a variety of others: and some of these cavities contain various sorts at one time; evidently intimating, that by the medium of water, with only as much atmospheric air, probably, as it contained, the animal matter has decomposed, and a new arrangement

* A similar effect may be produced by a blow; but it is not believed that a blow is the operating cause in the above instance, because those marks are visible in parts that are protected from violence.

has taken place; and if not actually arriving at the gaseous elementary state, those substances of which the body was composed have at least found their affinities, and thus become distinct and tangible forms.

By this law of affinities, then, I account for the nodules of indurated clay, or lime-stone, and for the flints. Of the lime-stone thus: some particle of animal or vegetable matter in a state of decomposition, by a peculiar affinity, has attracted the carbonic acid, or lime, or iron in aqueous solution, every incremental particle, probably, increasing that attractive power: and the flints nearly in a similar way; for as we find flints always in strata, I imagine that certain animal bodies have been thrown down, and enveloped by sudden depositions of chalk; which organic substances have possessed a peculiar affinity for "silex" (percolating in aqueous solution, as now acknowledged), or, as I suspect future researches will bring to light, "siliceous fluid," or "silicic acid gas;" and that gradual declining of siliceous properties discoverable on the exterior of those nodules; otherwise the gradual change from flint to chalk, is to be accounted for by the juices expressed from those organic bodies; diluting in its progress with other fluid, its affinity for silex has in the same ratio been lost.

That every real chalk flint has had a nucleus of organic matter, no one, having paid any attention to them, will doubt. I believe, indeed, that it is now generally acknowledged: outlines to these creatures can rarely (never perfectly) be traced: that they were marine, is probable from the numbers of pieces of shell enveloped in them, and no land sustance. Many of these shells have in like manner had an affinity for silex; while others evidently have not, but remain calcareous in the heart of the flint. Some of the oyster tribe, and the belemnite, appear to possess that repugnance to silex.

In a geological point of view, these flints are of great importance; for they convey the mind into retrospective ages, distant indeed!

First, these having been the offspring of the chalk, their parent bed has been destroyed, and they have been dispersed over the earth, by the last flood.

The inference to be drawn from this is, that the whole of the chalk cannot have been deposited by the last flood!

Secondly, no trifling concussion can have effected their fracture in a right line; and the very circumstance of the fracture being so, proves that the shock must have taken place while the stones were confined in a "consolidated bed;" and the violence affecting them, must have been in the two opposite directions.

That the action of the concussion has been of considerable duration is proved, by the intermedial quantity which many of them have lost; for in some, only a very small slice is left, to cover a surface of twice or thrice its extent. And that it has not been the effect of what is commonly known as a "slip," or falling in, or collapsing, of any portion of the earth, is sufficiently evident, from the remnants, in many instances, being restored, after abrasion, to a centrical position.

Thirdly, how many ages must have elapsed, ere, by the internal efforts above described, they can have not only re-united, but recovered in those parts their hardness, and in many instances their pristine translucency and entire appearance!

Fourthly, their formation while in the chalk will carry us back to a distance of time not to be computed, but doubtless, ages of undisturbed repose.

Lastly, as all ideas connected with their origin retire before inquiry, and as there are no data from which we can form any notion of the state of nature prior to the account given us by Moses, every attempt to proceed beyond that gulf must be presumptuous and idle speculation. But it appears to me, that flints may have derived their existence from ages prior to those of man; and, perhaps, many of those various masses of substance,

the chalk among the rest, constituting the crust of the earth, were "*in statu quo*" ere the existence of our species.

(To be continued in our next.)

STEAM ESCAPE FOR BOILERS.

Sir,—Your correspondent, Mr. Saul, in the last part (No. 58) of the "Mechanics' Magazine," wishes that some of your ingenious readers would point out a plan whereby the steam which escapes from the lid of the boiler (in use at the Lunatic Asylum at Lancaster) may be got rid of. In answer, I should say, this may be done by a very simple improvement. Let the lid be on hinges, and made to shut down close all round, and fastened in the front by two or three nuts. A conducting pipe should then be placed on the top in the manner above shown, having a tap at A: when the steam begins to press upon the lid, the tap is turned—of course that overflow of the steam will pass out wherever it is conducted. Having brewed my own beer for some time, I found it necessary to adopt a plan similar to the above to get rid of the steam, and have found it perfectly effectual.

M. S***

COMPOSITION ROOFS.

Sir,—Not having seen a perfectly satisfactory answer to a question respecting composition roofs (page 313, No. 223), I will endeavour to make it as plain as possible. I need hardly tell you that those who prepare the composition, keep it as secret as possible. In summer, equal parts of pitch and tar are boiled, until, on being allowed to cool, they become extremely tough; in cold weather, they are boiled till a small quantity, put on a bit of slate to cool, will crack. When brought to either of the above states, add equal quantities of pounded and *finely sifted* chalk and *sharp washed sand*, until the composition in the pot is as stiff as mortar. Keep it well stirred, while adding the chalk and sand. The operator should have an iron pot set so that the heat, after leaving the pot, passes under a hot plate made of pieces of cast iron, on which the sifted chalk and washed sand should be dried. Nor should the mixture take place until *every portion of moisture* is evaporated. The composition is thrown on and levelled with irons, having a wooden handle to ship on and off. Provide likewise an iron bar, with a hook or bend in the middle, to carry the composition from the pot to the work. The dip for the work is 1 inch, nor ever more than 1¼ inch in ten feet. I have no doubt but that an economical roof may be made by laying this composition on a pricking-up coat of lime and hair: the joists need not be thick, as they would have no weight to carry. I should advise using double or treble fir-laths, and plenty of hair in the pricking-up coat, leaving it as smooth as the trowel usually does. Perhaps, the better way would be to float it, as by that means it would be more level.

I am, Sir,

Yours, &c.

W. L.

Brighton.

P.S. The irons to smooth the composition are about 9 inches long, 4 inches wide, and 2 inches thick.

BRICKS MADE OF IRON SCORIÆ.

Sir,—I understand that it is customary, at some of the iron works in Sweden, to convert the scoriæ into bricks, which are used in con-

structing furnaces. Probably some of your numerous readers can inform us of the mode in which these fire-bricks are made; and why the same plan is not adopted by our iron-masters, who are greatly incommoded by the scoriæ, which often occupy many acres of ground, and who might thus derive considerable advantage from what is at present no small annoyance.

I am, &c.

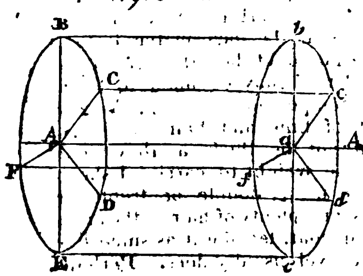
FERRARIUS FABER.

Reading, Feb. 1828.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

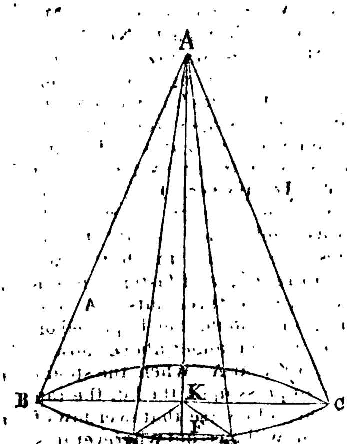
(*Continued from page* 60.)

As we shall hereafter have occasion to refer to the solid contents of a cylinder, we will proceed to consider how they may be ascertained.



Suppose E F B C D to be a circle whose centre is A, and suppose A a A an indefinite straight line perpendicular to the surface of the circle, and passing through its centre; then suppose the circle to be drawn along with its centre always in the line a A, and its surface always parallel to its first position, it will form the cylinder B C D E F b c d e f. Suppose also the square B C D E to advance along A a A, in the same manner. If the square be of the same size as the circle, and move through the same space, the rectilinear figure B C D E b c d e, which is formed by it, will be exactly equal to the cylinder. Now, suppose we divide the sides B C, C D, and the axis A a, into inches, it is evident that the number of cubic inches will be represented by B C $\times$ C D $\times$ A a, or by the area C D C B $\times$ A a. And since the cylinder is equal to the figure whose cubic contents $=$ C D^2 $\times$ A a, we have the cylinder itself $=$ C D^2. A a. But C D^2 we suppose equal to the circle F E D B; and therefore the cylinder $=$ F E D B $\times$ A a $=$ F E D B. A a; or the cubic contents of a cylinder are equal to its base $\times$ into its altitude; and if the radius $= r$, and altitude $= x$, we have the solid $= c\, r^2.\, x$.

We will give one more instance of the method of limits, and apply it to finding the surface of a cone A B D C, whose axis A K is perpendicular to its base.

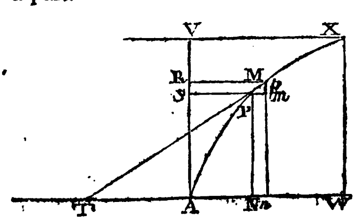


Let the base be divided into a number of small arcs, all equal to D E. Join D E, A D, A E, and draw A F perpendicular to D E. Now the sum of the triangles A D E, which are very small, is nearly equal to the surface of the cone, and the more we subdivide the base, the nearer do they approach to it. Hence the surface of the cone is the limit of the sum of the triangles A D E.

Now the triangle A D E $= \dfrac{\text{A F. D E}}{2}$, and the sum of these triangles $=$

$\frac{AF}{2}$ · sum of D E's. But the more we subdivide the base D E C B, the more nearly will the perpendicular A F approach to the sloping side A D of the cone, and the sum of the magnitudes D E to the circle B D C. Hence A D and the circumference of the base are the limits of A F, and the sum of the parts D E; and $\frac{AD}{2}$ · circumference of the base, is the limit of $\frac{AK}{2}$ · sum of D E's; and, therefore, in the same manner, of the sum of the triangles A D E, as the surface of the cone. And that surface must, therefore, be equal to the rectangle under the slope side, and half the circumference of the base. If a = altitude, r = radius of base, surface $= cr \sqrt{r^2+a^2}$.

This method of limit is applicable to many problems connected with the circle, but it cannot well be applied to measure other curves. Another method was used in some cases for this purpose, before the invention of fluxions, called the Method of Indivisibles. Here lines are supposed to be made up of points, surfaces of lines, and solids of surfaces. We will give, as an instance, its application to finding the area of a parabola.*



Let A P X W be a parabolic area; complete the parallelogram V A W X. Draw N P $n\,p$ perpendicular to A W very near to each other; join p P and produce it to meet the axis A N in T; also draw p R, P s, parallel to A W, and produce N P, S P, to meet p R $p\,n$ in M and m.

* As we shall, hereafter, have occasion to speak more at length concerning the parabola, we shall say nothing at present concerning its construction.

Now, if we make $p\,m\,n$ move up close to M P N, the line T P becomes nearer and nearer to be a tangent to the curve at P; and the parallelogram P n and P R become more nearly equal to the straight lines of which, according to this method, we suppose the areas A P X W and A V X to consist. Now supposing, therefore, P T to be a tangent to the curve at P, the nature of the parabola is such that N T is equal to 2 A N.

But by similar triangles we have $p\ m : m\ P :: N\ P : N\ T$ (2 A N; therefore we have 2 A N $p\ m$ = m P N P; or the parallelogram P n = 2 P R.

This, it is evident, is not strictly true, while we suppose n P and P R to exist as parallelograms; because while N n has any magnitude, P T is not quite a tangent at P. But as soon as we make $p\ n$ move quite up to P N, P T becomes correctly a tangent, and P n P R become each one of those indivisible straight lines, of which we suppose (according to this method) that the areas A P X W and A V X are composed; and this result (P n = 2 P R) being true of each pair of indivisibles, we perceive that the area A P X W = 2 area A V X; whence it follows that A V X is one-third, and A X W two-thirds, of the parallelogram V W.

(To be continued.)

FORMS ON SURFACES OF WATER.

Sir,—Having a cellar which admits the water in certain seasons of the year, when the springs are high, and a well in the lowest corner, for convenience of emptying it; the first time the water rose considerably above the floor, I remarked that the wooden frame of the well, whose rim was three inches below the brickwork, had, as I thought, displaced itself, and had risen to the exact surface of the water; but on applying a stick, to my no little surprise, what I supposed to be the wooden edges of the internal well-frame, were nothing but some small particles of scum, so exactly of the

shape of the frame, and so much resembling it, that I did not discover my mistake till I fully proved it. Every time the cellar was cleared, and the water rose again, the exact appearances were repeated. Reading, in No. 223 of your entertaining work, the surprise of Mr. John Hugill at something similar in the ice, induces me to forward you the following attempt at a solution—which is, That whatever bodies are in a place where the water rises gradually and very slowly, all minute floating bodies naturally attach themselves about their edges, and as the water rises above them, the said particles, not finding any other substance to cause them to change their position, preserve the form last touched, and in that shape will continue to float on the surface as high as it rises; but when a porous body sinks in still water, it soon gives out some gaseous particles, which are conveyed to the surface, either by putrifaction, or escape of the air formerly inclosed, which is now let loose by the saturation of the water in its place causing the body below to emit them; and, although few and small, yet in sufficient quantity to give a shade, or faint outline, (more particularly if the surface is already frozen,) and to cause the appearance described. Should this theory be correct, the following inference may be drawn:—That if a body impervious to air, such as a granite stone, were at the bottom, and the water gradually rising above it, the impure or adventitious floating particles would congregate to the edges of the *top* of the stone, and then be raised perpendicularly, with the surface of the water, in the form they left the stone; but if no floating particles or impurities existed in the water, there would be no appearance of any shape on the surface, either frozen, or not: or if the same body had been a substance of a porous nature, as wood; or putrescent, as flesh; then gas would have escaped, and carried up such impure floating particles as it touched in its way to the surface, and formed a faint shadow; but if no adventitious particles were in the way, there would be nothing seen on the surface, for, as it escaped, it would leave no mark behind, unless the surface were already frozen; in which case, these minute bubbles would remain under the ice in sufficient quantities to cause a shadow-like form of the body below, from which they ascended.

I remain,
A Well-wisher to Philophical Inquirers,
S. CHALGRAVE.

N. B. If the water in a well rise quick, and especially if it enter from one part only, the scum has a continued circular slow motion on the surface parallel to the side of the well.

PRESERVING SPECIMENS OF NATURAL HISTORY.

Sir,—One of your correspondents wishes to be informed of the best method of preserving specimens of Natural History. The means I have adopted to preserve the entire skins of animals and birds are as follow:—

Having provided myself with a sharp scalpel or pen-knife, a pair of forceps, and a pair of strong though fine scissors, I place the animal on its back, and make an incision through the outer skin only, from the throat to the vent; then, with the forceps holding up the skin on one side, separate the remainder of the skin from the flesh down to the first joint of the legs, if an animal, and to the wing and leg, if a bird; with the scissors, cut through these joints, separating them from the trunk: perform the same operation on the other side; then cutting through the neck, close to the head, and detaching the vent, raise one end of the body, and proceed to separate the skin from the back; lastly, cut away as much flesh as possible from the legs, or wings, draw out the eyes and brains, and cleanse the head with tow or any absorbing substance. The skin is then taken off entire, with the beak or mouth, legs, wings, and tail, attached to it; now lay it on a

plate, and apply alum in powder (which must be well rubbed on with the finger) over all the interior surface: let the skin thus remain for a week or two, and when dry, put it into a close box, with lumps of camphor in it. The skin, thus preserved, will keep uninjured for almost any length of time. The operation may be performed in ten minutes, and if care be taken not to cut into the cavity of the body, nor to tear the entrails, with the greatest cleanliness.

If it be required to stuff a bird, proceed as before, till after the wings and legs are cut off the body; then with the knife and scissors cut from the breast, through the ribs, to the leg on each side, thus removing the breast, and leaving the back bone and part of the ribs attached to the skin; then carefully remove every portion of the viscera, draw out the eyes, tongue, and brains with the forceps, and cut away as much flesh as possible from the wings and legs, place tow in the cavities to absorb the moisture, and let it thus remain a day. If it be a large bird, the tow will require frequent changing. Cut out a piece of cork, of the form and size of the breast of the bird. The next day place this cork in the cavity that the real breast occupied; previously removing the tow, and spreading a plentiful mixture of alum, camphor, and black pepper, all reduced to a fine powder, over *every interior* part of the bird: with a wire pointed at one end, and of a suitable length, and placing the wings in the position they are intended to remain, pierce the pinions and the cork. Thrust pointed wire up each leg, and let the points firmly fix in the cork; pass a wire down the throat to enter the cork. Now bring the skin to its natural position, and sew it neatly together; bend the wires of the legs and neck to what form you please, and, with nippers, cut off what remains out of the throat, but leave some at the wing and legs to fix the bird in a frame, or on a perch. The eyes are usually made of glass, and are to be purchased of any colour; but, for small birds, the eye may be made of black sealing-wax, melted on the nob of a pin, turning it round in the flame of a candle, to give it a proper form and size, then cut the pin, leaving a sufficient length to fix the eye to the head of the bird. The case to receive the bird should be well made, and without fissures, that the air may not enter, and it may be ornamented with paintings, moss, shells, &c. To give a good position to the bird, and to sew it up neatly, require practice; and I have only endeavoured to give an outline of the process I have adopted, which may be varied, in some respects, according to the taste or skill of the operator.

In a few years, it is possible that small insects may drop from the bird, and which are smaller than the mites in a cheese: when these appear, the bird should be taken from the case and placed in an oven, in which some charcoal must be burnt; the fumes will destroy the animalculæ, and the heat will dry up their eggs.

The above method of stuffing birds will apply to animals, care being taken to cut the cork of a proper form to supply the place of the flesh and viscera that are removed.

Yours, &c.

A. Z.

Purton, Wilts.

COIN FOUND AT ST. CATHERINE'S DOCK.

Sir,—I am much obliged to Δ. for his observations on the coin of which I sent you a drawing. I have abandoned the idea of its belonging to Eric, of Northumbria; and I cannot bring myself to think that it is of Canute, for no part of the coin can possibly be read CNV.T, or even CNT. The following are all the variations which the coin will allow, in my opinion:—

1. ERIC LE ROIX SEN, or ZEN.
2. ERIC LE ROI HYBN.
3. ERIC LE R DIFLEN.
4. ERIC LER DNS HN.

Of the first of these, I can make nothing. The second, meaning "Eric, King of Ireland," is not at all strained; nor is the third, signifying "at Dublin," with the exception of the letter F in DIFLEN, which is rather equivocal. The fourth, reading "Eric LER, Lord of Ireland," *i.e.* DOMINUS HYBERNIÆ, is forced, and worth little.

How the French style "Le Roi" came to be adopted, I am utterly at a loss to determine, as I know of no instance of its use previous to the time of William of Scotland, who is styled WILLIEM LE REL. Were it not for this circumstance, I should be content with the second reading. I would just mention that the LE in LE ROI is so plain that it cannot possibly be read otherwise.

With respect to the reverse of the coin, I was certainly mistaken in supposing it to mean "Leofwyn at Antrim." I believe the correct reading is LEOFWINEN AMT; *i. e.* MONETARIUS, or Moneyer.

Submitting these observations to the consideration of Δ.,

I am, Sir,

Your humble Servant,

JOSEPH BROWN.

Cannon-street, Feb. 9, 1828.

N. B. I forgot to add, that supposing the coin to be Canute's, no part of it can signify "ANGLORVM," or any abbreviation of it; nor can it be read "CYNYNG," the Saxon original of "King."

MEAN AND APPARENT TIME.

Sir,—I will reply, as briefly as possible, to the letter of "Vectis," in No. 230, page 423.

In the first place, I did *not* state "that the difference of longitude *must* be obtained from the difference in *mean solar time*, and never from either the *apparent* or *sidereal* time." I said, that the statement by "Rus Astro," "that in converting time into arcs, it is usual to allow 15° for one hour in *time*, whether that time be given in *mean solar* or sidereal time," was incorrect, and "that the 15° are allowed for one hour MEAN SOLAR time."

If, as your correspondent says, 15° were allowed for, or, what is the same thing, are equal to, one hour, *mean solar*, and also *sidereal* time, then *one hour of sidereal time is equal to one hour of mean solar time!*

To extricate himself from this dilemma, "Vectis" says that "the sun's mean right ascension at mean noon" must be added to the given mean time, in addition to its proportionate part of 3 m. 56·55 s. in 24 hours. This addition "*appears* to have" corrected the difference in longitude; "I say *appears*, because I intend to show" that his calculations have "not been properly made." According to "Vectis's" calculation,

6 h. 35 m. 19·77 s. + 23 h. 11 m. 58 s. = 5 h. 47 m. 18 s.! and

14 h. 8 m. 44·04 s. + 23 h. 11 m. 58 s. = 13 h. 19 m. 28 s.!!

But when the addition is made properly, the first amount is 5 h. 47 m. 17·77 s. and the second 13 h. 20 m. 42·04 s.; the difference between this and "Vectis's" erroneous (*unintentionally* erroneous, no doubt) amount, is 1 m. 14·04 s.; and between the first correct and erroneous amounts 0·23 s., which, added to 1 m. 14·04 s., makes 1 m. 14·27 s.; which, converted into motion, is 18′ 34″, *the difference between the solar* (if I may be allowed the expression) *and sidereal longitude, as stated by "Rus Astro" and "Astro Solis."* To what purpose, then, is the addition of "the sun's mean right ascension?"

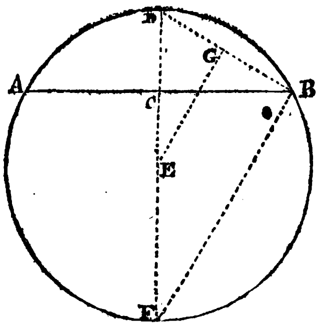
In conclusion, I beg to state, that although I still deny, in opposition to your correspondent, the possibility of obtaining correct results by allowing 15 m. for one hour *sidereal* time, yet I certainly acknowledge it, when correct numbers instead of 15° are made use of. As the necessary calculations are easily made, I will not intrude further upon your pages by detailing them.

I am, Sir, yours, &c.

HENRY H——.

Carmarthen, Feb. 18, 1828.

HOW TO CALCULATE THE RADIUS OF AN ARCH.



Sir,—I ordered my foreman, last week, to get, in a certain part of my building, an arch constructed of 20 feet span and 6 feet rise. My foreman is a bit of a mathematician, and set the desired arch A D B out upon a scale, by drawing A B = 20 feet, and on the middle of that line, the perpendicular C D = 6 feet; then the straight line D B, which he bisected, and drew G E perpendicular on D B, and producing the line C D, it gave him the point E at crossing the line G E, and thereby getting E D as radius of the circle A D B F, whereof the segment A D B formed the desired arch. "Bob," said I, "dost thou know of any other mathematical way for doing this?" After a little thinking, he said, that none struck him at that time. "Produce D C," I said, "and draw a line B F at right angles; mark the point where that line cuts your produced line, and the line from that point to D will form the diameter of the sought-for circle; for proof, see prop. 31, 3d book of Euclid." "Master," said he, "I wish you would give me some method of calculating how much the radius is to be, when the span and elevation are given?" "Well, Bob," said I, "I'll think of it." When I accordingly that evening was seated by my fire-side, and had lighted my pipe, the thing occurred to my mind, and I hit upon the following expedient:—

As the sine of one arc stands to its versed sine, as the sine of another arc also stands to its versed sine, consequently CB : CD :: CF : CB; *i.e.* $10 : 6 :: x : 10$, or $100 = 6\,x$, and $x = 100 \div 6 = 16\tfrac{2}{3}$ for C F
add 6 for C D

and we get $22\tfrac{2}{3}$ for the diameter, $\div 2 = 11\tfrac{1}{3}$, or 11 feet 4 inches for radius.

The morning after, I told Bob that when the span of an arch and the elevation are given, he has only to square half the span and divide the product by the elevation; to the quotient add the elevation, then half the whole sum, which gives you the desired radius; and I showed him why it does so. Bob was much pleased, and will adopt this system in future. By honouring this communication with a place in your Magazine, I shall know that you find it worthy of that place; and in that case I may, perhaps, trouble you again with a few more morsels of such-like productions.

I am, Sir,
Yours, &c.
ABEL DABLER.

Manchester.

WHITE'S CONCENTRIC PULLEY NOT A NEW INVENTION.

Sir,—By a French treatise, published seventy years ago, it appears that a pulley, denominated White's Patent Pulley, is not his original contrivance. The work is entitled, "*Cours de Mathematique*," *par Camus*, 1750. In the second vol. page 136, pl. 12, figs. 94 and 95, are given the description and figure of the pulley. It is a book that belongs to the excellent and valuable scientific library of Mr. William Jones, Optician, of Holborn, and who is willing to show it to any of your readers. That experienced and learned artist believes, that in other foreign works he has seen it described. In the first, or old edition of "Emerson's Tracts" (Mechanics), 8vo., pl. 3, fig. 42, the pulley is also represented.

VERITAS.

WOOD-CUTTING MACHINE WANTED.

Sir,—Being about to emigrate to New South Wales, I am induced to inquire of your ingenious readers, whether the power of oxen could not be applied to some simple piece of machinery for cutting down timber, so as to clear land more expeditiously than by manual labour; and if one of them would be kind enough to furnish me with a drawing of such an instrument, (if practicable,) having as little iron in its construction as possible, which might be easily made by a settler himself, possessed of a little skill, and so light as to be moved from one tree to another without loss of time, he would greatly oblige,

Yours, &c.
W. A.

DEPOSIT IN ENGINE BOILERS.

The best remedy against the crust which forms in boilers, is to give the boiler, when clean, a good coating of gas or coal tar.

TIM BOBBIN.
Manchester.

MISCELLANEOUS NOTICES.

A Lost Star.—A very remarkable star appeared in the year 1604, near the right foot of Serpentarius; it surpassed Jupiter in magnitude, and its brilliancy exceeded that of every other star: when near the horizon it shone with a white light, but in every other situation it assumed alternately the varying colours of the rainbow. It gradually diminished in splendour, till about October 1605, when it disappeared, and has not been seen since.

Lime Water.—It is a curious fact with regard to lime water, and to the solubility of lime generally, that cold water takes up more than hot water. Water at 32 degs., or thereabouts, dissolves 11 grains of lime; at 60 degs., only 9 or 10; and at the boiling point, not more than 5 or 6 grains. This appears to depend upon some mechanical property of the particles of lime—the particles appearing to cohere together at high temperatures.

Ambergris.—The origin of this substance is involved in complete obscurity; all that we know of it is, that it is most commonly found in lumps floating on the ocean, sometimes in the stomachs of fish. But whence does it come?—by what process is it formed? Every body knows the history of that greasy substance called Adipocire. On digging up the bodies in the cemetery of St. Innocents, at Paris, many of them were found in part converted into a substance resembling spermaceti; and it has since been ascertained, that if the flesh of animals, instead of undergoing putrifaction in air, undergo the slower changes which take place under water, in a running stream, it is gradually converted into this substance. It is not an improbable conjecture, that ambergris is the flesh of dead fish which has undergone this change,—that it is marine adipocire. And this conjecture is corroborated by a fact which was lately stated in one of the American newspapers. "A marine animal of gigantic size, has lately been discovered and dug up in the neighbourhood of New Orleans, in the groove of one of whose bones was found a matter closely resembling ambergris. This animal, which is supposed to be extinct, had been buried for an incalculable time."

College Learning.—Nearly every one of our valuable discoveries in the mechanical arts, have been the produce of men not mathematicians; often absolutely ignorant of almost the name of mathematics, and very frequently utterly uneducated. The very worst minister of marine which France ever possessed, was the mathematician Monge; and excelling us, surely, as the French have for a long time done in mathematical science, we have almost invariably outstripped them in ship-building. We have very lately outstripped them, conspicuously, in the person of Sir Robert Seppings; himself, if I have rightly understood, so ignorant at first of the commonest principles, that he did not even understand what was meant by the resolution of forces, and could not comprehend the principle of his own invention, even when it was explained to him.—*London Magazine.*

Night Blindness.—"In our way back through the town, a man begged of me, saying he was blind. On my calling him, however, he came forward so readily to the torches, and saw, I thought, so clearly, that I asked him what he meant by telling me such a lie. He answered that he was night blind (rat anda); and I, not understanding the phrase, and having been a good deal worried during the day with beggars, said peevishly, 'Darkness is the time for sleep, not for seeing.' The people laughed, as at a good thing; but I was much mortified afterwards to find it was an unfeeling retort. The disease of night blindness, that is, of requiring the full light of day to see, is very common, Dr. Smith said, among the lower classes in India; and to some professions of men, such as soldiers, very inconvenient. The Sepoys ascribe it to bad and insufficient food; and it is said to be always most prevalent in a scarcity. It seems to be the same disorder of the eyes, with which people are afflicted who live on damaged or inferior rice—in itself a food of very little nourishment—and probably arises from a weakness in the digestive powers."—*Bishop Heber's Journal.*

Nutriment from Woody Fibre.—It appears from the valuable researches which Dr. Prout is now pursuing in his "Analysis of Organic Substances," that the ligneous fibre of plants is capable of becoming a substitute for grain, for human food, in periods of scarcity, by undergoing the following process:—A given quantity of wood fibre, in shreds, or shavings, being well macerated in boiling water, in order to deprive it of the resinous and extractive matter, is to be well dried in an oven, and subsequently ground or reduced to an impalpable powder, having the appearance of brown flour or meal. With a certain portion of leaven this flour may be fermented, and formed into a tenacious paste; and, when well baked, is not inferior in quality to ordinary wheaten bread from undressed meal. A tolerably good variety of starch may also be obtained by boiling wood-flour in water, till the liquid acquires the form of jelly, when cooled. In fact, this gelatinous substance, *vis fæculæ*, constitutes the nutritive qualities of the preparations of all vegetable substances for human food.

Discovery of America.—It is a common belief, that one of the ideas upon which Columbus built was, that the land on this side the globe must be balanced by some counterpoising quantity on the other, and Dr. Robertson adds his authority to this opinion. This has always been cited as one great proof of the scientific calculations of the navigator. It is curious that, in Mr. Irving's account of the 'grounds on which Columbus founded his belief of the existence of undiscovered lands in the west,' to which he devotes a chapter, and which, he states, he takes directly from the life of the Admiral by his son—there is no mention of this opinion at all. Nor can it very easily be supposed to have existed, when we reflect that Columbus utterly mistook the size of the earth, and believed it to be much less than it really is. Thus, by leaving out the whole extent of the Pacific Ocean—*India*, as it was always called in the mass at that day, *i. e.* Asia, would be where the West India Islands now are, without any necessity for counterpoise at all. In fact, Columbus did not expect to discover new lands, but only a new route to lands already known. His expectation and his hope were to arrive at *Cipango*, which has usually been construed to be Japan, and subsequently at Cathay, in the dominions of the Grand Khan, as described by Marco Polo.

The Cocooy, Queen Beetle.—This astonishing insect is about one inch and a quarter in length, and what is wonderful to relate, she carries by her side, just above her waist, two brilliant lamps, which she lights up at pleasure with the solar phosphorus furnished her by nature. These little lamps do not flash and glimmer, like that of the fire-fly, but give as steady a light as the gas light, exhibiting two perfect spheres, as large as a minute pearl, which affords light enough to the darkest sight to enable one to read print by them. On carrying her into a dark closet in the day time, she immediately illuminates her lamps, and instantly extinguishes them on coming again into the light.

Hindoo Mode of Fishing.—"The fish were pursued in the shallow, muddy water with sticks, spears, and hands, in all directions; but there was little execution done, till four Bheels, in the service of the Odeypoor government, made their appearance. The rabble were then driven away; and these savages, with their bows and arrows, made in a few hours such havoc among the fish, as produced plenty in the camp; singling out the largest, and striking them with as much certainty as if they had been sheep in a fold. Their bows were of split bamboos, very simply made, but strong and elastic,—more so, I think, than those of buffalo-horn, which are generally used in Hindostan. They were about four feet six inches long, and formed like those of Europe. The arrows were also of bamboo, with an iron head coarsely made, and a long single barb. Those intended for striking fish, had this head so contrived, as to slip off from the shaft when the fish was struck, but to remain connected with it by a long line, on the principle of the harpoon. The shaft, in consequence, remained as a float on the water, and not only contributed to weary out the animal, but showed his pursuer which way he fled, and thus enabled him to seize it."—*Bishop Heber's Journal.*

Ant Soup.—A singular description of food is made use of by some tribes of the Snake Indians, consisting chiefly, and sometimes wholly, of a species of ant, which is very abundant in the region in which they roam. The Squaws go in the cool of the morning to the hillocks of these active insects, knowing that then they are assembled together in the greatest numbers. Uncovering the little mounds to a certain depth, the Squaws scoop them up in their hands, and put them into a bag prepared for the purpose. When a sufficient number are obtained, they repair to the water, and cleanse the mass from all the dirt and small pieces of wood collected. The ants are then placed upon a flat stone, and by the pressure of a rolling pin are crushed together into a dense mass, and rolled out like pastry. Of this substance a soup is prepared, which is relished by the Indians, but is not at all to the taste of white men.

Essence of Coltsfoot.—"This nostrum is composed of balsam of Tolu, tincture of benzoin, and rectified spirits of wine. It contains *no coltsfoot*, and is one of the most baneful medicines that could have been imposed on the public in pectoral cases."—*Stevenson and Churchill's Medical Botany.*

Green Colour in Oysters.—M. Gallion, the author of an interesting memoir on the cause of the green colour in oysters, has discovered that it is produced by the *Conferva comoides*. He has seen the greenish corpuscles, which form its axis, become detached, advance with more or less rapidity, change place, and, in short, act in all respects like *enchylides* and *cyclidia*. Taking entire filaments, he forced these minute beings to separate before the time; and, in this case also, they manifested the same voluntary movements. Their propensity to associate is so great, that, whenever the young can do so, they arrange themselves, one after another, in a single line; and, when in this position, M. Gallion thought he observed them to exude a mucosity, which formed itself into a membrane and entirely enveloped them.

A Word to Cavillers.—"There are some men of narrow views and grovelling conceptions, who, without the instigation of personal malice, treat every new attempt as wild and chimerical, and look upon every endeavour to depart from the beaten track as the rash effort of a warm imagination, or the glittering speculation of an exalted mind, that may please and dazzle for a time, but can produce no real or lasting advantage. These men value themselves upon a perpetual scepticism—upon believing nothing but their own senses—upon calling for demonstration when it cannot possibly be obtained, and sometimes upon holding out against it when it is laid before them—upon inventing arguments against the success of any new undertaking; and when arguments cannot be found, upon treating it with contempt and ridicule. Such have been the most formidable enemies of the great benefactors of the world; for their notions and discourse are so agreeable to the lazy, the envious, and the timorous, that they seldom fail of becoming popular, and directing the opinions of mankind."—*Dr. Johnson.*

NOTICES TO CORRESPONDENTS.

Communications received from Mr. Woods—Mr. Dowling—Mr. Jopling—Mr. Dubois—Mr. Keat—Mr. Baddeley—A Subscriber from the First—Mr. Locke—Andrew Ambrose—Philo-Musicus—Q. E. L.—Mr. Mackinnon—T. W. P.—A Grateful Subscriber—J. H—s.—An Admirer of Naval Architecture.

Supplement to Vol. VIII. is now ready.

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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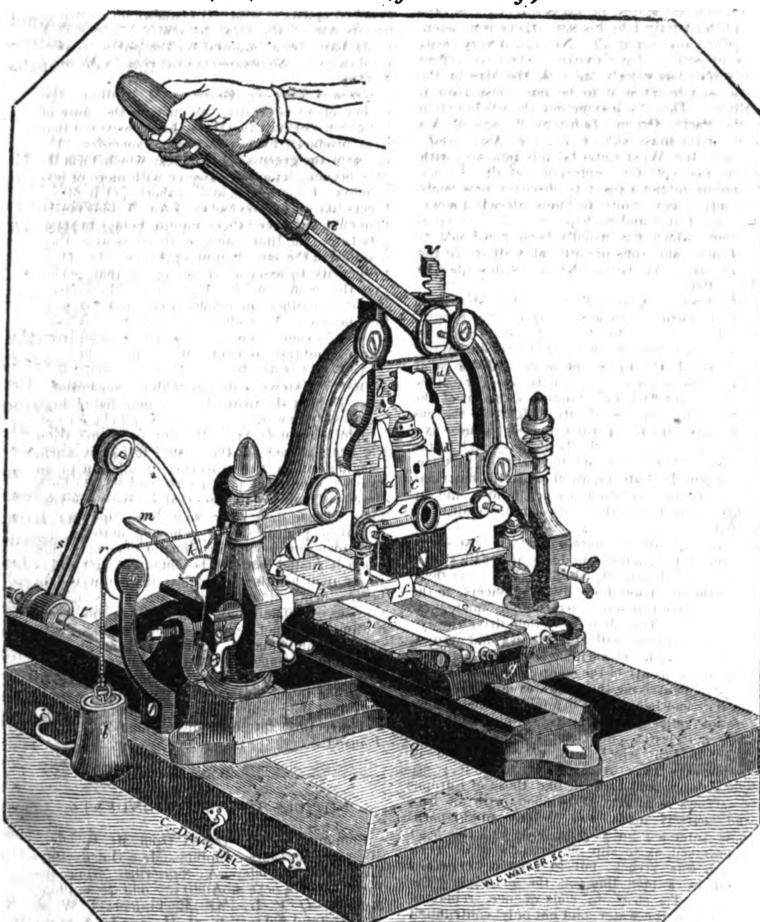
LYNE'S COMB-CUTTING MACHINERY.

(Communicated by Mr. C. Davy.)



The machine represented in the above admirable specimen of wood-cutting, obtained the prize of £10, given last year by the Rev. R. Fellowes, for the best machine invented by a member of the London Mechanics' Institution.

It consists of a mechanical contrivance for cutting the teeth of horn and tortoise-shell combs, so as to effect a saving of about three-fourths of the material, as well as of the time and trouble hitherto required in this operation. Two combs are cut at one time; and the action is performed merely by raising and depressing a lever, *a*, represented in the prefixed engraving.

To understand, however, more fully, the mode of working the machine, the following references may be consulted. As it is first of all requisite to *fix* the horn or tortoise-shell to the machine, this is accomplished in the following manner. On the plate *n n* are two steel springs, *c c*, which, by a screw and spring fixed near *p*, are pressed down to the above-mentioned plate *n n*. Now, by unscrewing and raising these springs, they can be lifted from the plate, so as to allow the horn or tortoise-shell to be placed under them; they are then fixed down by the aforesaid screw—thus keeping the material perfectly steady. That the cutter or knife *f* may *easily* penetrate the horn or shell, there is a hollow space *g* under the plate *n n*, to receive an iron sufficiently heated to keep the horn or shell in a pliant state. The whole of this part of the machine slides upon a lower stand of cast iron *q*, to allow a sufficient number of teeth to be cut, as the compass or size of the stand will admit of. The sliding motion of the frame is effected as follows:—On the opposite side of the machine are compound levers (connected by a horizontal bar *t*), to which the cord and weight *l* is attached, passing over the pulley; so that by raising or depressing the lever *a*, the ratchet,* &c. *i k* is made to act, and through the agency of the weight *l*, will move the sliding frame *n n g* the width of one tooth. When the frame has been moved onwards by this means to its full extent, it can be brought back again by turning the handle *m* at the end of the ratchet, which causes it to act upon a revolving screw under the stand *n n g* for this purpose.

Method of Cutting the Teeth.

At the lower end of the lever *a*, is a pinion giving the alternating motion to the racks *b b*, which, pressing upon the cylinder *c* (containing a stout heliacal spring), will descend, and give the necessary incision to the horn or shell; but as the teeth are required to be cut in a *tapering form*, the racks *b b* have wipers *u u* fixed to them, which, acting alternately upon the springs *d d*, will cause the piece *e* (fixed to the cutter) to be thrown each time in an *angular position*, instead of a *parallel position*. Finally, the steel rods *h h* are also pressed down alternately to disengage the two combs from each other.

* The ratchets are altered according to the width of the teeth required to be cut.

ON CERTAIN FLINTS FOUND IN THE MIDLAND COUNTIES; WITH AN INQUIRY INTO THE ORIGIN OF SILICEOUS BODIES IN GENERAL.

BY MR. EDWARD GRIMES.

(Concluded from page 72.)

When we come to consider the depth to which man has penetrated, and that he constantly finds the same substances ranged in the same order, to the very extent of his researches; the length of time necessary to deposit, according to common observation, first, so great a quantity of matter, even from water in a state of perfect tranquillity, and then to consolidate it; also the precise order, the tesselated arrangement, if we may so describe it, of all the various kinds of earth, and the improbability of the same body of water, under the circumstances of agitation which we have reason to believe the Deluge must have been in, having retained, distinct and separate, as it were by walls, solutions of substances so totally different, and they contiguous to each other! I do not presume to come to any decision: I merely desire to suggest to the contemplation of others, the possibility of many of these strata which we impute to deposition from the waters of the Deluge, having had an antecedent origin. We are told that the waters existed ere the earth was built into a shape fit for the reception of man. "The earth was without form, and void, and darkness was upon the face of the waters."

It is impossible, not being acquainted with the extent of idiom made use of by Moses, to comprehend the exact import of these words; but it may be reasonably conjectured that the earth existed, though it might have been covered with water, or even in a state of minute division in commixture with the water. The process of collecting the waters into one place, and causing the dry land to appear, it seems natural to suppose, was effected in the way by which similar effects are to this day produced; namely, by causing the waters to deposit the earth which they held in solution; and this process might possibly have effected the envelopement and destruction of myriads of creatures. And in corroboration of this hypothesis (though there may be circumstances at enmity with it), one cannot suppose that any figure was intended, in the account given by Moses, of Noah taking into the Ark two of every creature upon the face of the earth for their preservation, in order that they might increase and multiply; yet, remains of numerous creatures are discovered, which, as far as the researches and experience of man in these enlightened days go, are extinct!

But to proceed to a further investigation of the conjoining matter of flints. It is remarkable, that those re-united, above-mentioned, are generally, though not altogether, of the pure black kind; they are sometimes of the grey kind.* "Faults" or "slips," also, are found in siliceous slates, beautifully re-united; and I have in my possession, one piece of "chert" taking the form of a wall or crust, in the manner in which celestine is found, with shapeless matter annexed to it: this crust has been fractured like the flints, and many angular pieces are attached to the side of it by a siliceous cement.

There can be little difficulty in supposing, that the substance uniting flints, and that composing the hardening or compacting matter of "chert," are the same; it will, therefore, assist us to pursue our inquiry under that head. In process, however, we ought to understand what is exactly meant by "chert," of which I have never seen a good definition. I should instantly decide upon a piece of chert if I saw it, but I could not give a correct description of it. I have usually considered it to be "a basis of organic remains in the form of carbonized lime, highly impregnated with a condensed siliceous matter;" while "chalk flints" appear to have been "organized bodies in their native state," invested in the same way.

But the variety of those substances denominated "chert," is very considerable. Derbyshire is, in this country, one of its principal laboratories; and it exhibits phenomena relative to it, which are difficult of explanation. The grey limestone there, known as black marble, is perforated with it in every direction, as though it had been drilled through, and filled up with the liquid matter.

When I was still more partially acquainted with this circumstance than I am now, I imagined these perforations to have been effected by roots of trees, while the stone was in the state of soft earth; but that cannot be the case, for they pass through the madrepore, and the madrepore itself forms part of the chert:—no; it has more the appearance of the effect of electric fluid. Whatever the actual cause may have been, there has been no respect of substance. This chert is generally black; sometimes more tough than flint, and sometimes it has natural joints, is brittle, and falls into angular pieces, generally of a rhomboidal form.

The shady madrepores of the Wiltshire downs are of another description, partaking more of the character of agate and jasper.

The gravel of the midland counties is replete with cherty substances innumerable; formerly, no doubt,

* Chalk-stones are sometimes found under similar circumstances, but the conjoining matter is invariably carbonate of lime; also marble.

calcareous, and now often in part so. The cherts of the neighbourhood of Bristol, again, are varieties: there too, the limestone is penetrated in the same kind of way as in Derbyshire; but the colour is different.

But one of the most remarkable phenomena connected with chert, is the property possessed by the Derbyshire black marble of changing by exposure, to the substance called "rotten-stone," or disintegrated chert: a notorious instance of it is exhibited in the sun-dial at Chatsworth. It appears, upon examination, that about one half of this limestone is in fact siliceous; and there can be little difficulty in supposing that the lime has been decomposed, and washed out by the weather, leaving this minutely divided substance behind. Now, may we not, with some degree of reason, suppose that this bed has in former times been a mass of pure limestone? Taking that for granted, the old school will declare that one half of its particles have been washed away; and, by the process of percolation, siliceous particles have been substituted for them; and indeed, the effect that the weather has apparently had upon the sun-dial, will go far to bear them out; but nature seems to have appropriated no colour to silex, and dividing and comparing the two treated of ingredients of this stone, we find the one and the other are of the same dark colour. From this, may we not infer that the lime has been invested by the silex in a gaseous state? and whether this was by injection, or was effected by the process of a new arrangement, cannot be ascertained; but it may be supposed that the supply was not equal to the whole body, and therefore those particles having the greatest affinity for the silica have profited by it.

And again: if the two bodies had been held in solution, and deposited together, they would not have incorporated in such just proportions; the silica being about 0.65 heavier than the common limestone.*

We come now to the consideration of another extraordinary laboratory for chert, and this is the "Isle of Wight."

The chert is there visibly creeping upon the green sand: now this stratum or bed, appears to have been before invested with silica, for a considerable part of its substance is siliceous,* and a part still remains calcareous; moreover, it is full of shells, which are many of them cherty or chalcedonous, having acquired a translucency by this investment. And so we find the same effect produced upon that part of the green sand which, being invested the second time, has been changed from a loose, disintegrated, opaque body, into a solid, compact, translucent body; moreover, the casual rents have been filled up by the same substance in a pure transparent state; and which is usually denominated chalcedony.†

* The limestone cropping out at Dundee, is converted at the sea side to rotten-stone, but of a different colour. It contains numerous nodules of what, I must suppose, were formerly organized bodies, now compact siliceous masses, concentrically formed, of various colourings; which contain, in some instances, crystals and masses of transparent quartz,—the substance evidently with which they have been invested. These stones are known as agate or Scotch pebbles; there are also some bloodstones.

Many brown umbreous earths, used as pigments, will be found to be rotten-stone or chert in a disintegrated state; they are not uncommon in siliceous rocks, and are found also in limestone. I have five now before me, which were collected from the following places. From Llampeter, rocks between Llanrwst, Capel Voelas, Bangor, Cerrig y Druidion, foundations of Penrhyn Castle.

* The siliceous particles of the green sand are often of considerable magnitude; but I do not infer from that, a necessity for their having been accumulated from sand already in that form. I think it extremely probable, that their conversion into silex, and their attainment of the present integral form, were synchronal efforts of nature, and took effect while in their present locality. I have specimens of organic remains from the interior of large flints, in the state of native sand!

† I have in my possession a grey

Now, to give a philosophical reason for supposing that "silica," the substance causing opaque green sand to become translucent, chert, &c. is a fluid, and not an earthy body in solution, we must inquire into its connexion with optical properties.

Light travels, or is at least, conveyed to the human eye "through a medium:" and there are certain media by which it is conveyed more readily than by others.

In this respect, it resembles "sound," and we will illustrate by the comparison.

Sound travels much farther through an atmosphere, when highly impregnated with moisture than when dry: much farther in a congealed dense atmosphere than when the same is lax and ill-connected. It may be compared to a harp string, when in a state of tension, and when otherwise.

Glass, in its integrated state, will convey sound in an unusual proportion; but reduced to powder, it will not assist it at all.

Sound is reflected and refracted by meeting with surfaces; and where there are many opposing surfaces, it is exhausted and lost; whereas, had those many surfaces been one continuous plain surface, the sound would have been thereby conveyed to a great distance. So, when the sea is smooth, sound will travel upon its surface a very long way; when agitated, the echo or reflection of the sound is much greater nearer the place whence it arises, but the extent of its journey in a right line is proportionally contracted.

In all these respects, there is a close analogy between sound and light: neither of them, when reflected from many surfaces at different angles, is capable of so great extension, as when, having penetrated the surface of its medium, it is further unobstructed.

We know, when the surface of the water is smooth, to what a distance we can discern the bottom; but if agitated, we cannot see it at all, because the sun's rays and the rays of vision (which are the sun's rays reflected from objects to the eye) are repelled both ways by the uneven surface of the water, and cannot, therefore, penetrate it so readily. Every one in the habit of bathing in the sea, or rather of diving, can vouch for the darkness of the watery region in stormy days, when compared to those of calm and tranquillity.

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flint, about an inch thick, and from two to three inches diameter; found about twenty feet under clay, sand, and vegetable soil, in a heterogeneous mixture of those substances, with a gravel of flints, chalkstones, and a predominating quantity of common septaria. This stone appears to have had greater extent in every direction, except that of its two broadest sides; so that it must have been a slab, but of what size it is impossible to determine. One side has the common whitish appearance of a flint from which the chalk has been worn; the other is not so, but impressed all over with extraneous angular bits of the same kind of flint, white as chalk from decomposition; from those pieces which protrude, the investing matter appears to recede, precisely as if they had been pressed with the finger into melted resin half cold, or other such matter. But, on examination, the whole flint is filled with these bits; and the farther in they go, the less decomposed, or rather the more recomposed, they appear, till at last they become perfectly assimilated with the body of the stone, and are perceptible only by a very slight difference of colour, or a ferruginous line.

These "debris" then, already flint, but only white by decomposition, serve in their new state, to show the penetrating character of the substance which composes flint and chert; and with this specimen in my hand alone, I should directly pronounce that the investing particles must have been infinitely more minute than any solid could be conceived to be; for the whiteness and opacity of the extraneous pieces disappear gradually as they sink deeper in; and at length they become together one homogeneous mass.

My idea of the origin of this stone is, that the juices from some contiguous organic body have extended in its direction, and attracted, or composed, the silicifying fluid, by mixing with other gases, enveloping these broken pieces: for I do not think it necessary that the formation of all flints should have been simultaneous.

So; a mass of sand, though composed of the clearest particles, is yet impervious to the light; because the rays are so frequently refracted from their right course, that they are expended before they can pass through.

The effect is the same, if that sand be partially united and incorporated into a stone; but if it be dissolved by fire, and compacted into a solid homogeneous mass, with no more surfaces, within or without, than are sufficient to compose a body, the light passes through it with the ease that we see it does through glass.

When light meets with an opaque body, *i.e.* a body which it cannot penetrate, it is thrown back, or reflected, in an angle equal to the angle by which it approached.

When light meets with a transparent body, although it pass through it, it is partially obstructed by every surface that it meets with; and the rays, being thereby bent out of their right course, are said to be "refracted."

Every known body is a compound of particles, and every particle must, of course, have its surface; therefore all bodies, capable of transmitting light, refract in a greater or less degree: wherever the ingenuity of man can introduce a body of light, there must be a surface; therefore, whether a body be, or be not, properly speaking, a perfect homogeny, it must have an exterior surface, which will refract the rays of light.*

It is almost needless to observe, that no known solid is so perfectly compact, or homogeneous, as to have no interior surfaces; and for that reason, and that only, the thinner it is, the more easily the light is transmitted: that which we should call "dirt," when obstructing the visual ray—through glass for instance—being only a substance in the state of minute division; and colour, probably, the same, but capable of reflecting certain rays only. Glass, in any very considerable body, is opaque from these causes.

Now, as certain earthy bodies are hydrophanous, or have the property of transmitting more light when their pores are filled with water; and as the effect would, probably, be the same, or greater, if it were possible to fill these pores with solid pure glass;—I venture to suppose that the substance investing "green sand," and forming it into "chert," must have been, at the time of its passage, a perfect homogeneous fluid (in common parlance), or gas; because no substance, conveyed in solution in any extraneous vehicle, has sufficient attraction among its particles, when deserted by that vehicle, to re-unite those particles, once in a state of division, into a solid body capable of the transmission of light, without a greater degree of refraction* than is incidental to water: therefore, if that substance filling the pores of the green sand were merely a deposition of earthy particles, every one possessing its surfaces, and, consequently, its powers of refraction, the passage of light, instead of being assisted, would thereby be still further obstructed.

Thus again (to illustrate by a modification of the example), no human art could associate that most transparent of solids—the diamond—in any numbers, in a manner sufficiently compact to disguise wholly their refractive faces; neither particles of the clearest quartz, so long as they remained

* The property of attraction or resistance that a surface requires under the pressure of the atmosphere, may at any time be illustrated, by immersing a a common house fly in a basin of water; where, if he be below the surface, he has little or no power of locomotion, though he struggle ever so hard; but lay him on his back, and let his feet approach the surface, and he will walk along it, as he would along a pane of glass.

* The "refraction" here spoken of, is that which obstructs the light in its passage, but seldom affects its rays beyond the limits of the body: because the resistance is equal on all sides. Thus, a bullet shot through a bag of sand would in no wise be refracted; but a small part of the resistance it met with, if opposed to one side only, would very considerably affect its direction.

integral particles (and this again is surely well illustrated in the substance called "refracting spar," where the joints are probably much more closely and accurately adapted than could be effected by art); but if we dissolve these particles of quartz by heat, thereby dissipating that medium which caused the repulsion of its individuals, then, indeed, the mass becomes "one," instead of "many," and the light passes freely through it.

And to explain more fully that property called "hydrophaneus," which is common to some stones, to wood, paper, linen, and various other bodies, it is simply that the atmosphere is a medium too thin and weak to convey light in opposition to many obstructions: but water, or any other transparent medium of greater attraction among its particles than air, when occupying the pores of any solid, partially obscures the reflective faces of its particles, and forms, at the same time, a better vehicle for the light.

It is upon this principle, I imagine, that the opaque green sand becomes translucent when converted into chert; that flints, when in their homogeneous state, are translucent, opaque when disintegrated, or decomposed, and chalky; and thus, upon a similar principle, that is, as bodies which are dense, or of great attraction, are better conductors of light, than those which are unstable, yielding, and absorbent. If our atmosphere had been water instead of air, the absence of the sun during the night might not have occasioned so great an obscurity; considering that the repulsion of the rays of light at its outward extremity had been provided for with such sublime forecast as in the present instance—namely, by gradual rarefaction: yet, in the day-time, we might not have had so much light, because the rays of light do not penetrate it so readily in a right line; but it has higher powers of refraction than air.

I will only add to this: That iron appears to enter frequently into the composition of siliceous bodies;

That it seems not improbable that, though water may not actually convey silex in solution, yet that it may be necessary to its formation;

Lastly, that salt water, or sea water, appears to be particularly conducive to that end. Substances are frequently to be found upon the sea beach, particularly "wood," and of apparently recent growth, completely silicified; about Shanklin in particular, masses of shells, partly siliceous, partly pyritic with iron, and pieces of siliceous wood, are frequently associated.

EDWARD GRIMES.
Coton House, Warwickshire.

FIRE ESCAPES.

Mr. Editor,—On looking over the seventh volume of your useful publication, which was lent to me by a friend, I accidentally observed Mr. Barnard's plan for a fire escape, (No. 289, page 210). It immediately struck me, that Mr. B.'s plan, though very ingenious, was not exactly "the thing." One objection to the cot is, that it must first be brought to the place of danger, and the time lost in so doing, as well as in raising it (amid the confusion of a fire), might often be fatal; not to mention the chance of the sockets of the pole giving way, or the pole itself breaking: the only advantage a cot seems to have over a ladder, is the greater ease of conveying it to the scene of danger. Mr. Barnard also seems to have forgotten the extreme likelihood of the ropes being reduced to ashes by the flames issuing from the windows below: when it is considered that escape from a window will only be resorted to, when the flames, entirely enveloping the lower part of the building, have cut off all other means of egress, it must be evident that the ropes are, to say the least, in extreme danger. This, Mr. Editor, is not a mere supposition: for I happened to be present at a fire, some years ago, by which a poor woman lost her life; the flames were so intense, as to set fire to a ladder which was raised, when too late, for her escape. The same

objection holds good with respect to the other plans, though in a much less degree, as the rope running over the pulley would constantly expose a fresh surface to the flames; whereas in the plan of the cot, the ropes would be comparatively stationary.

You will, I dare say, have guessed ere now that this *tirade* against Mr. B.'s plan is merely to introduce one of my own; if so, you are quite right. My plan may at first sight appear absurd, and indeed it may turn out to be impracticable; for I have, I confess, no means of trying the experiment upon a sufficiently large scale, though, I must say, the more I have considered it, the more I have been persuaded of the possibility of its being put into execution. It is merely an adaptation of the parachute principle. My ideas, perhaps, would be better explained by the enclosed *rough sketches*, which you will at once see are by no means those of an experienced artist.

The centre figure, which is the machine, or parachute, being nothing more than a large umbrella, needs no explanation; if it were made to form, when opened, a circle of about six feet diameter, it would, I should suppose, be sufficiently capacious. The shaft I would have of beech or elm, about five feet long, and terminating with an opening, as in the right hand fig., to admit the leather band which is firmly sewed to the *overalls*-like contrivance; which contrivance seems to me to be the simplest mode of attaching the umbrella to the person descending. I would propose, for additional security, that the ribs be *outside* the canvas or oil-skin with which it is covered. It seems almost needless to explain the method of use.

The person escaping, gets into the overalls, fastens the band (by means of a buckle) round his waist, taking care that the shaft is in front; and getting out of the window, as shown in the left hand fig., suffers himself to lose his balance—the wind catching the parachute, it would immediately right itself. I do not suppose that a person could descend, with the above apparatus, with the same ease as if he were walking down the stairs, but I presume that the fall would be so far broken as to cause but a temporary inconvenience; there is also the certainty of alighting on the feet, which appears to me an important consideration. If the parachute could be so made as to fly open on touching a spring, it would be perhaps better; as, from the length of the shaft, there might

be some difficulty in extending it: also, there would be no chance of its collapsing. Trusting that this communication, which is literally a first attempt at *authorship*, will be deemed worthy a place in your Magazine, and that it will not be found inconvenient from its length,

I am, Sir,
Your obedient Servant,
P.

Friday, Feb. 8.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(*Continued from page* 74.)

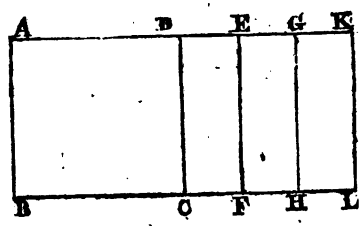
(10) It is evident that none of the expedients of which we have given examples, furnish us with a general method of ascertaining, either accurately or nearly, the lengths and areas of curves, and the surfaces and contents of solids. They are, as it were, isolated solutions of particular cases, displaying great ingenuity, but altogether inadequate to the wants of science; where we are frequently called upon to measure quantities which can, with difficulty, if at all, be expressed by a geometrical representation, and which, even then, cannot be reduced to any of the cases to which the contrivances are applicable. Newton and Leibnitz have the glory of discovering two systems which, differing in their principles and notation, are, in their application and results, identical.

Each method has certain advantages over the other; and, perhaps, by comparing the two together, we shall the sooner arrive at a perfect understanding of both.

(11) We will begin, then, with Sir Isaac Newton's method, called the Fluxional Calculus, or the Method of Fluxions.

Here every magnitude and figure is supposed to be formed by motion; a line by the motion of a point, a surface by the motion of a line, and a solid by the motion of a surface.

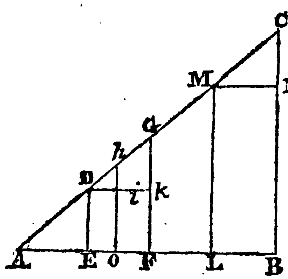
It is evident, from this consideration, that the curve or solid thus formed continually changes its magnitude; and the velocity with which it increases or decreases, at any point, is called its fluxion at that point. Thus, suppose the rectangle A L to be the figure, which, being



generated by the motion of the line C D along the line B C L, continually increases. Then, as C D is always of the same length, and moves uniformly along the line B C; if C F, F H, H L, are parts of the line B L, generated in equal lines by the point by which, according to this method, we suppose it to be described; the parts D F, E H, G L, will be equal and corresponding parts of the area H L, and will represent the velocities with which that area increases at the point C, F, H, &c.: or if C F, F H, H L, &c. are taken for the fluxion of the line B L (which we shall in future call the axis) at C, F, H, &c., the areas D F, E H, G L, &c. will be the fluxions of the area at the same point, C, F, H, &c. The axis B L is always supposed to be uniformly described; and therefore the spaces C F, F H, H L, &c., by which it increases in equal portions of time, are all equal, and the fluxion of the axis is a constant or invariable quantity: if we suppose the line B C L to represent the time of describing the parallelogram A L, and C F, F H, H L, &c. the times of describing the parts D F, E H, E L, &c., then D F, E H, G L, &c. will represent the absolute velocities with which the area of the rectangle increases. We have supposed the

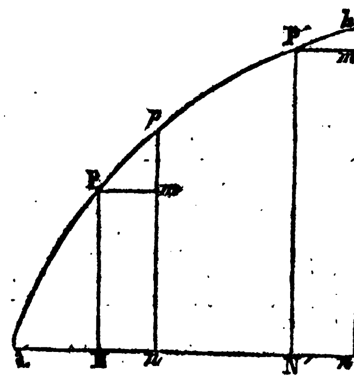
rectangle to increase at each step, in which case its fluxion is a positive quantity. Had it decreased instead of increasing, its fluxion would have been negative.

(12) In the case of the rectangle which we have just given, the increments, or parts by which the area increases in equal portions of time, are equal and constant; and are, therefore, the same as the fluxion of the area at any point, since they measure the velocity with which it increases. But this is not the case in other figures. Let us



take a triangle for instance, A B C, whose base is A B; let E F represent the space by which the base A E increases at the point E: then, since the base or axis, as we agreed to call it, increases uniformly, E F will represent its fluxion at the point E, and the space E D G F will represent the increase or increment of the triangle, in the time in which A E receives the increment E F; but this increment will not represent the fluxion of the area at E: for suppose we bisect E F in *o*, and draw *o i h* perpendicular to E F, cutting D *k*, which is parallel to EF, in *i*; then the parts DE *o h* and *o h* G F, by which the area is increased in the times E *o*, *o* F, are unequal, and D E F G is too great to represent the velocity at E. In order to obtain this, we must take the area D E F *k*, which would be described in the space of time E F, with the line ED continued constant; which will thus represent the fluxion of the area at the point E: similarly, L B being taken equal to E F, and M N being parallel to A B, the area M B is the fluxion at L.

It is the same in a curvilinear area.



If N *n*, N *n*, represent the fluxions of the axis at the point N N; and N P, *n p*, N P, *n p*, be drawn perpendicular to the axis, the increments N P *n p*, N P, *n p*, do not represent the fluxions of the area at N and N; but these are obtained by drawing P *m*, P *m*, parallel to the axis; which gives P *n*, P *n*, for the fluxions of the area; being the increment it would receive in the same time with P N, P N, continued constant through P N, P N.

(To be continued.)

ON THE KNOWLEDGE OF THE ANCIENTS.

Sir,—It is unfortunately the disposition of mankind to be always in extremes. On few subjects do we find men judge calmly, and without prejudice. They generally either laud to the skies, without a proper discrimination, and without the slightest notice of any blemishes; or as rashly depreciate without mercy, and pass over, as if they existed not, any merits which may be to be found in the object of their censure. With neither of these is truth to be found;—the one is too much prejudiced in favour of—the other too much against. Truth, then, lies somewhere between the two; and

for it a wise man will not look to either of these parties. "*Medio tutissimus ibis*," says Phœbus, in his advice to Phaeton; but he, by disregarding this advice, met with the fate his rashness merited.

On no subject has opinion fluctuated more than on the respective merits of the ancients and moderns. At one time—especially about the time of the revival of literature—the authority of the ancients was supposed incontrovertible; and even down to the year 1812, Aristotle continued the text-book in our Universities. But, of late years, the tide has turned; and it is now the *fashion* to depreciate the ancients, and cry up the praises of the nineteenth century, as if nothing valuable had been produced before it. Both extremes ought to be avoided; and in drawing a parallel between the ancients and moderns, it shall be my study to avoid falling into either extreme.

On the subject of the authors of each I shall be very brief. The ancients had one great advantage over us—in as far as it helped to bring their works to much higher polish and perfection—that they had *no* printing presses. An author thus wrote for fame (as indeed now; but *then*, it was for immortal fame —*now*, for the passing applause of the day); and this fame he could not obtain, unless he produced a work of such merit as to make it worth the while of the purchaser to pay the enormous price which it was necessary to pay for a copy—as they were all written, not printed. Authors consequently laboured, and polished their works, till they reached nearly to perfection. Now, an author writes a book for the day, suiting its style as much to its taste as possible. It is published; in less than a week we have twenty or thirty reviews—in a month, a hundred; it is lauded—it reaches a second, or even a third, edition—and is forgotten before the next publishing season, or pushed out of notice by some new work by the same author. Thus it is, that ninety-nine parts in a hundred—I might say a much greater proportion—of our literature, even exclusive of all the periodicals of the day, are only fitted for the present time.

The consequence is manifest; viz. that although, at present, knowledge is far more generally diffused than ever it was in ancient Greece or Rome, yet our authors of late days will not, *individually*, stand the test of comparison with those of ancient Greece.

It must be borne in mind that all the most celebrated lawgivers, statesmen, philosophers, poets, orators, &c. of Greece, flourished in the short space of about three hundred years; and that the whole population of Greece probably never equalled one-third of that of Britain, even inclusive of the slaves, who formed nearly three-fourths of the whole population, and were kept in total ignorance; and that the small State of Athens, which produced more illustrious men than all the rest of Greece, never equalled one tenth of the present population of London.

In Epic Poetry, the ancients have Homer, Virgil, Apollonius Rhodius, Lucan, and a few others; but though, of modern times, none have ever surpassed the two first of these—perhaps none ever equalled Homer—yet we have many names to show that we are not much inferior to them in this branch. In history we have some celebrated names; but I fear we cannot equal Herodotus, Thucydides, and Xenophon, among the Greeks, and Livy among the Romans. In tragedy, the Greeks can boast an Æschylus, Sophocles, and Euripides—but a small portion of whose works remains; yet these suffice to convince us that we can boast of no superiority to them, in this branch, even when we think of our matchless Shakspeare. In Comedy, though we have but eleven comedies of Aristophanes remaining, yet we know that in this branch the ancients were particularly rich; and these eleven are so full of real humour, wit, and nature, that we can never hope to surpass them. Need I mention Demosthenes, Isocrates, and Æschines, among the Greeks, as orators. Or Cicero, among the Latins—to prove that

they equalled us in eloquence? or the "divine" Socrates, or Plato, or Aristotle, or the innumerable other philosophers, whose names are so well known, and whose merits are so generally appreciated? or Euclid, or Archimedes, or Pythagoras, among their mathematicians? or the long list of generals and statesmen, whose talents and exploits have been the admiration of succeeding ages? There is, indeed, little need of labouring this part of the subject, as there are but few who are so ignorant or so blinded by prejudices, as not to acknowledge readily, that though we may equal the ancient worthies of Greece, we cannot surpass them. But many say, that while they equalled us in these respects, they were far behind us in all others. One sapient critic, in the Second Number of the "Foreign Quarterly Review," said, "that the Cæsars, in all their magnificence, could not have half the comforts of an English labourer." Though every one must see the absurd folly and gross ignorance of such an assertion, still it shows how strong the prejudice is in favour of the present age. But of this, more in my next.

I am, Sir,
Yours, &c.
FRANCOIS DUBOIS.

PROPOSALS FOR THE ESTABLISHMENT OF A SOCIETY FOR PREVENTING THE LOSS OF LIFE BY FIRE.

Sir,—I beg leave, through the medium of your columns, to call the attention of the public to a subject which has recently occupied no small share of its sympathy, viz. Loss of Life by Fire.

It has been remarked, as a strange circumstance, that, in an age like the present, there should be a lack of invention for preventing this dreadful calamity: it is, however, well known, that many ingenious machines have been invented, and many worthy characters have bestowed much labour of mind and incurred heavy pecuniary expense, in order to produce machinery calculated to prevent the evil above mentioned; several of these have been put in practice to prove their efficacy, yet very few have been adopted: it is therefore evident, that if the remedy be left to individuals, the evil will continue! I have, therefore, briefly sketched the outline of a plan, and respectfully submit the same for public consideration; trusting that, if approved, there will not be wanting characters to assist, by calling a public meeting, before whom a more detailed plan may be laid, in order to its adoption, or improvement.

I am, Sir,
Your obedient Servant,
JOHN HUDSON.
85, *Cheapside*, *Feb.* 6, 1828.

Proposals for establishing a Society for preventing the Loss of Life by Fire.

To form a body of men to be called "The Metropolitan Company of Fire-Escape Volunteers."

To divide the metropolis into square miles.

To accept the services of twenty volunteers resident within each square mile, to be recommended by churchwardens, or other respectable inhabitants of the several parishes. It is presumed there would be no difficulty in finding twenty respectable and suitable characters in each square mile, willing to render their services in an undertaking which would raise them in the esteem of society, interfere very little with their ordinary occupations, and to whom a remuneration is intended.

To appoint a Foreman to each station, either on the spot, or very near to the same, who should take the charge of keeping all things ready and in good order; likewise to instruct the men where the parish fire-ladders are kept within his district, and the quickest mode of using the same; also to encourage a friendly feeling between the volunteers and the firemen of the

several Insurance Companies, so that they may render mutual assistance in the performance of their important duties. To assemble the men on a stated day in the first week of every month, at five o'clock in the morning, during summer, and at day-break in winter, for the purpose of exercising in the use of ladders, &c., and to see that every implement be perfect, and that the full complement are in store; the whole to be completed within one hour, and each to receive three shillings.

To provide annually for each volunteer a jacket, waistcoat, trowsers, and cap.

To appoint a messenger, resident as near as possible to the station, whose duty should be to give notice to every volunteer in his district, whenever and wherever their services may be required.

To deposit in each station a set of ladders of proper lengths, a large tarpaulin, poles with hooks, ropes, links, one of the most approved Fire-Escapes, with such other implements as may be deemed proper; also a truck or carriage with four wheels, for the conveyance of ladders, &c.

To appoint a Secretary, whose accounts should be audited annually; together with a report of the proceedings of the past year, and always open for the inspection of Subscribers.

To appoint a Chairman, Treasurer, and Committee of Management.

To recommend to the proper authorities that a board be placed in a conspicuous part of each watch-house, with the names and address of the volunteers resident within the district, arranged in the order of the several beats, so that each watchman may be enabled to give notice at the instant of alarm.

It is obvious that the superintendent and the watchman will possess the power of rendering a most important assistance in cases of fire; and this circumstance cannot be too strongly expressed on their minds.

Subscriptions may be expected from every housekeeper, from wealthy and humane characters, from churchwardens for the time being, and from Fire Insurance Companies, in consequence of the great additional facilities in saving property.

If the above plan were carried into effect, it appears quite possible to obtain extensive and constant watchfulness throughout the metropolis at a very trifling individual expense.

SAFETY APPARATUS FOR PREVENTING ROBBERIES.

Sir,—At the time of the robbery of the Ledbury Bank, I turned my attention to the invention of something that should prevent, or at least render it much more difficult to commit depredations so extensive and ruinous; and I have now invented something, which, when applied to the doors and window-shutters of a house, or room, it shall be impossible for any person, even if there are no locks or bolts, to enter that house or room without first making an effectual alarm.

The contrivance is simple, and not likely to be out of repair for many years: it can be fixed to any door without alteration, and to inside window-shutters with a very trifling one; and the whole expense for the outside doors of any house, with the window-shutters and doors of a banking-room, or other room where valuable property is deposited, including what I charge for the invention, superintending its construction, &c. will be under 10*l.*

I intend to take out a patent as soon as my time will permit; in the mean time, persons wishing to have the Safety Apparatus affixed to their premises, may apply to

Your obedient Servant,

PAUL READ.*

Stroudwater Academy,
Gloucestershire.

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* Or *Keat*, we cannot from the writing say which.—EDIT.

FALL OF ANOTHER ROOF—DESTRUCTION OF THE BRUNSWICK THEATRE.

We lament to have to add another to the many instances which have occurred, of late years, of roofs of new buildings tumbling in, and occasioning great destruction both of life and property. The new Brunswick Theatre, which was recently erected on the site of the old Theatre in Goodman's Fields, and only opened to the public on Monday, the 25th of February, was, during a rehearsal on the Thursday following, totally destroyed by the sudden descent of the roof, and the falling in of the greater part of the walls along with it;—about twenty persons were overwhelmed in the ruins, and at least eleven are ascertained to have lost their lives. Among the latter was one of the proprietors, Mr. Maurice, a gentleman who had embarked the whole of a considerable fortune, acquired in the printing trade, in the unhappy speculation, and who will be long held in honourable remembrance by his friends, for the amenity of his manners, and his sterling worth.

As usual, every body concerned in the affair is busied in shifting the blame from his own shoulders to thsoe of his neighbours; and if everybody might be believed, nobody at all is to blame. Mr. Stedman Whitwell, the architect of the Theatre, has published a letter in the newspapers, in which he asserts that its downfal was owing to circumstances over which he had no control; while the friends of the proprietors, who did possess, or ought to have possessed, such control, have, in answer to this disclamation of Mr. Whitwell's, called on the public to suspend their judgments, till an inquiry now in progress is completed, when they engage it shall appear, that whoever was to blame, the proprietors were not. While matters are in this state, it would of course be premature to offer any opinion on the subject; it is no more than fair, however, to Mr. Whitwell, whose professional character is so deeply involved in the issue, to observe, that the case, as he states it, seems only to require to be proved, to exonerate him completely. He asserts,

"1. That the walls of the building were of proper strength and thickness, and in every respect fitted for their legitimate purposes.

"2. That the roof, which was of *wrought* iron, was lighter than one of wood, and in every respect sufficient for all purposes for which it was constructed.

"3. That a large floor, extending over a great part of the theatre, together with the floors over the stage, and all the machinery of the theatre, weighing many tons, were supported chiefly by being suspended from the roof, contrary to the object of the roof, and without any reference to the plans upon which the theatre was erected.

"4. That over these erections I had no control whatever; they being expressly excepted from, by written agreement.

"5. That, nevertheless, I frequently and urgently remonstrated against this improper use of the roof.

"6. That, after communicating with me on the subject, the constructor of the roof protested, *in writing*, agaist the additional loading of the roof.

"7. That from the nature of the construction and materials of the roof, I knew that no accident could take place, without a notice from its appearances which would afford ample time to prevent all personal danger.

"8. That such notice of the failure of the roof under its load was, in fact, given and observed by the responsible persons, more than twenty-four hours before the catastrophe; but that I was kept in utter ignorance of this most important circumstance.

"9. That although I never, either directly or indirectly, sanctioned the suspension which caused the accident, but, on the contrary, repeated my warnings from time to time; yet I examined the roof on Monday evening, the last occasion of my being at the theatre (my occupation there having quite finished), and could perceive no symptoms of failure."

We are glad to perceive one good effect which has resulted from this deplorable accident:—it has served to rouse Government to a sense of the propriety of placing the erection of all large structures under some such system of superintendence and control, as that which we suggested in our 189th No. Mr. Peel, in answer to a question from Sir John Newport, in the House of Commons, stated that measures were in contemplation, to guard against the recurrence of any more disasters of this description.

MISCELLANEOUS NOTICES.

The New Palace.—Notwithstanding all that has been said as to Mr. Nash's having no hand in the erection of this architectural monstrosity, a Mr. Henry Pellatt, of Ironmongers' Hall, now asserts, in the "Times" newspaper, that "Mr. Nash did declare to him, above three years ago, that if any obvious fault should be discovered in the then intended New Palace, in St. James's Park, he alone would be responsible; for that the entire erection and completion of this work had been specially committed to his care by His Majesty."

Extraction of Salt.—The following is the mode of effecting this object pursued at the great Salt Works, near Bex, in Switzerland, as described by the Rev. Mr. Walter, in his "Letters from the Continent."—"With regard to such of the water as is very strongly impregnated with salt, the process is very simple:—it is boiled, for some time, in immense caldrons, and then run off into spacious coolers, where the salt soon forms in crystals on the sides and bottom. But there is much of the water, which contains so little salt that it is scarcely perceptible to the taste. The boiling this would be endless, and, more than that, attended with enormous expense. In order, therefore, to get rid of the soft water, as they call it, and, at the same time, to retain the salt, the following simple yet ingenious process is adopted:—Vast sheds are constructed, about three hundred feet long, fifty wide, and one hundred high; they are open at the sides, and are erected in situations most exposed to the action of the sun and wind. The space in the centre is filled with faggots of fir-tree branches and thorns: the water is raised by means of most ingenious pumps (some twenty or thirty of which are kept in perpetual exercise by the agency of four cubic inches of water falling on a wheel thirty-four feet in diameter) to the top of the building, and is there distributed with beautiful regularity over the whole surface of the faggots: through these, which, be it recollected, constitute a mass ninety feet high, and twenty wide, the water filters, drop by drop, into a basin beneath. In its progress, the earthy particles it contains, remain attached to the faggots in the form of stalactite, the soft water evaporates, and what reaches the basin is as strongly impregnated with salt as the most productive which the mountain affords; it is thence conducted by pipes to the boilers, and is treated as the first. This operation is simple, but the effect is wonderful; the reservoirs for the reception of the water from the mountain, and for that which has undergone the process of evaporation, are close together; and the two are as different in taste as river and sea water."

The Doctor made Captain.—People would laugh, now-a-days, to hear of any of our scientific doctors being honoured with a pair of epaulettes, for the sake of promoting and rewarding his scientific pursuits. Yet we read, that in the time of William III., the celebrated astronomer Dr. Halley was appointed commander of the Paramour Pink, (though no sailor,) that he might, by voyaging about in that vessel, ascertain the rule of variations of the magnetical compass. Queen Caroline (the consort of George II.) having visited Halley, at the Royal Observatory, Greenwich, when he succeeded Flamstead as Astronomer Royal, Her Majesty took notice that he had formerly served the crown as a captain in the navy; and through her influence he afterwards obtained a grant of the half-pay of an officer of that rank, which he enjoyed to the end of his life.

Steam Vessels.—The advantages derived from steam navigation in the late war with the Burmese have not been forgotten in India. Two steam-vessels are at present building in the dock-yard of Calcutta, from plans and designs by Sir Robert Sepping, each of which is to have two forty-horse power engines.

Calculating Powers of Animals.—It is uncertain whether this faculty exists in animals. It is asserted, that a bitch perceives if one of her puppies is taken away; but it is not evident that she counts her young ones: she may perceive, by the faculty of individuality and form, that an individual is wanting. George le Roi has observed, that magpies count three; for, if there be a hut in the neighbourhood of a tree upon which a magpie has placed its nest, and if three persons enter this hut, the magpie is not deceived—it does not come to the tree before the three persons have left the hut; but if more than three persons enter, it can no longer reckon their number, and cannot compare the number of those who are gone in, with that of those who are gone out. Dupont de Nemours, however, thinks that magpies can count nine.—*Farrier and Naturalist.*

Air Plant.—The Number of "Edwards's Botanical Register" for March, contains a figure of the fine new Air Plant of China, long known to Europeans by the drawings of the Chinese, and celebrated for the splendour of its flowers and the fragrance of its perfume. It has for some years been cultivated in the stoves of this country, but no means could be discovered for making it flower, till a new method was pursued by the gardener of his Royal Highness the Prince Leopold, at Claremont, which finally proved successful. Under his mode of treatment a branch of blossoms was produced, between two and three feet long, and composed of some hundreds of large flowers, resplendent with scarlet and yellow. This plant has the remarkable property of living wholly upon air. It is suspended by the Chinese from the ceilings of their rooms, which are thus adorned by its beauty and perfumed by its fragrance.

Quality of Wool.—At the last sitting of the Imperial Society of Agriculture of Moscow, M. Skiadan, proprietor of some fine flocks of Merinos in the Government of Voronige, exhibited an instrument of his invention, called an *Eriometre*, for ascertaining the thickness or fineness of the wool with the greatest exactness.

Atomic Illustration.—Every body knows, that if a filament of Indian rubber be drawn out by a force applied to both ends, it becomes attenuated in exact proportion to its elongation; so that although a change of form, no change of volume, takes place; but it gains in one respect what it loses in another. It seems natural to suppose that the same would be the case with a metallic string. Such, however, is not the fact. If a metallic string be moderately drawn out, the

diminution of its diameter will be found to be less than it would be were its attenuation exactly equivalent to its elongation: whence it may be inferred that a sensible void is produced between the particles of which the metallic string is composed.—*Literary Gazette.*

New Musical Instrument.—It is well known that a column of air, when made to vibrate properly, is a source of sound as effectual as a string, a plate of metal, or a glass bell. A column of air may also be made to reciprocate to other sonorous bodies, when its vibrations accord with those of the latter. For example: if a vibrating tuning-fork be held to the embouchure of a flute, and the fingers applied so as to stop the holes in the manner necessary to produce the different notes; the moment the flute is stopped, so as to produce the same note, with the tuning-fork, it instantly produces a clear, full sound, though in all other positions nothing could be heard. Thus the flute is made to speak without any air being blown through it, and solely by reciprocation. The same effect is produced by bringing tuning-forks to the mouths of bottles which have been selected as containing columns of air vibrating in unison with the forks, or even by bringing a tuning-fork before the aperture of the mouth, and adjusting the latter until the air within it reciprocates to the fork; when instantly a clear sound is produced. Mr. Wheatstone (the inventor of the Kaleidophone described in our 207th No.) has devised an instrument, to be constructed upon this principle of the reciprocation of columns of air, which he calls a Terpsiphone.

Defensive Instinct.—A snail having crept into one of Mr. Reaumur's bee-hives early in the morning, after crawling about for some time, adhered by means of its own slime to one of the glass frames; where, but for the bees, it would probably have remained till either a moist air, or its own spume, had loosened the adhesion. The bees having discovered the snail, immediately surrounded it, and formed a border of propolis (a resinous substance, collected by the bees for the purpose of attaching the combs to the roof and sides of their dwellings, stopping crevices, &c.) round the verge of the shell, which was at last so securely fixed to the glass as to become immoveable.

"For ever closed the impenetrable door,
He sinks on death's cold arm—to rise no more."

Maraldi has related a somewhat similar instance. A houseless snail, or slug, had entered one of his hives: the bees, as soon as they observed it, pierced it with their stings till it expired beneath their repeated strokes; after which, being unable to dislodge it, they covered it all over with propolis.

"Embalm'd in shroud of glue the mummy lies;
No worms invade, no foul miasmas rise."

"In these two cases," says Mr. Bevan, "who can withhold their admiration of the ingenuity and judgment of the bees? In the first case a troublesome creature gained admission into the hive, which they could neither move nor destroy: here, then, their only resource was to deprive it of locomotion, and to obviate putrefaction; both which objects they accomplished most skilfully and securely, and with the least possible expense of labour and materials. They applied their cement where alone it was required, namely, round the verge of the shell. In the *latter* case, to obviate the evil of putrescence, by the total exclusion of air, they were obliged to be more lavish of their material, and to form with it so complete an incrustation, as to guard them from the consequences which the atmosphere so invariably produces upon all animal substances that are exposed to its action after life has become extinct. May it not be asked, What means more effectual could human wisdom have devised under similar circumstances?"

Phases of Venus.—When Copernicus revived the ancient Pythagorean system, asserting that the earth and planets moved round the sun, it was objected that in such a case the phases of Venus should resemble these of the moon. Copernicus made for answer, that some time or other that resemblance would be found out; and so, in fact, it was, by the no less celebrated Galileo. In a letter written from Florence, in 1611, to William de Medici, the Duke of Tuscany's ambassador at Prague, Galileo, after reciting how he had discovered that Venus had her changes exactly the same as the moon—increasing and decreasing, and having her illuminated part constantly turned towards the sun—thus proceeds:—"We have hence the most certain sensible decision and demonstration of two grand questions, which, to this day, have been doubtful, and disputed among the greatest masters of reason in the world. One is, that the planets in their own nature are opaque bodies,—attributing to Mercury what we have seen in Venus: and the other is, that Venus necessarily moves round the sun; as also Mercury and the other planets;—a thing well believed, indeed, by Pythagoras, Copernicus, Kepler, and myself; but never yet proved, as it now is, by ocular inspection upon Venus."

Providence of the Parisian Printers.—Of the total amount of members of the provident societies of Paris, the number of individuals connected with the press forms a fourth part. Paris gives employment to 6000 persons of the male sex, in the different professions immediately connected with printing and engraving; and more than half that number are united in provident societies, which guarantee them from the need of relief from an hospital: but of the 300,000 individuals of other callings which Paris contains, only 10,330, a little more than a thirtieth part, belong to any friendly societies. It is thence fairly inferred, there is fifteen times more sense and care among the journeyman printers, than among the members of all the other callings followed in the French capital.

NEW PATENTS.

George Jackson, of Saint Andrew, in the city of Dublin, attorney-at-law, for his invention of certain improvements in machinery for propelling boats and other vessels, which improvements are also applicable to water-wheels and other purposes.—19th January—6 months.

Joshua Taylor Beale, of Church-lane, Whitechapel, in the county of Middlesex, engineer; and George Richardson Porter, of Old Broad-street, in the city of London, merchant; for their new invented mode of communicating heat for various purposes.—19th January—6 months.

NOTICES TO CORRESPONDENTS.

Mr. Ottley's reply to G. S. has been accidentally overlooked; it shall appear in our next.

S. Y.—H. I******.—and J. shall also appear, if possible, next week.

Communications received from Burin—Mr. Woods—Benevolo—Tim Bobbin—Mr. Shires—W. H. O.—The North Star—Thomas Dalby—John Walker—N. O. R.—An Eye Witness.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-Row, London.

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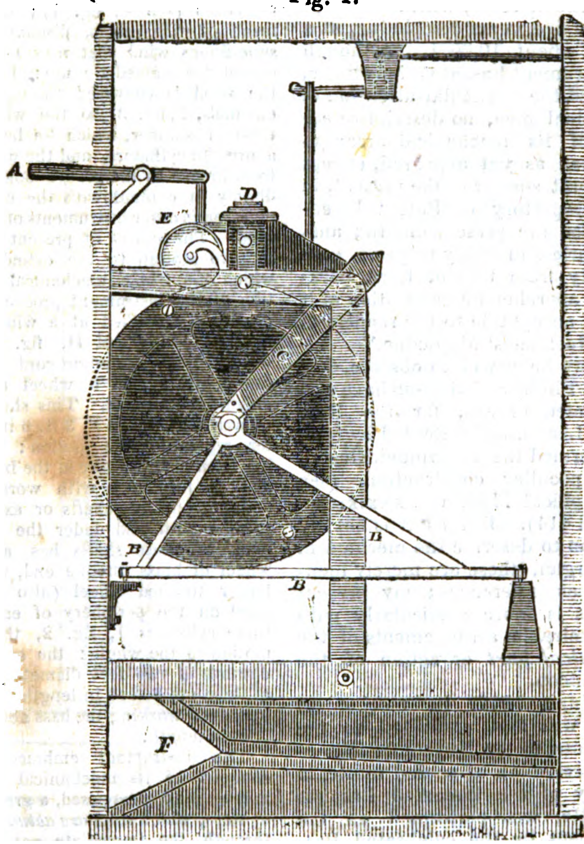
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 238.] SATURDAY, MARCH 15, 1828. [Price 3d.

THE APOLLONICON.

Fig. 1.



Description of the Apollonicon, invented and constructed by Messrs. Flight and Robson, Organ Builders. By Mr. C. Davy.

[Communicated by the Author, along with Drawings of the accompanying Engravings.]

The public attention has been directed for some time past to a most magnificent instrument, invented and constructed by Messrs. Flight and Robson, the eminent organ builders, 101, St. Martin's Lane, generally known to the musical world by the name of "The Apollonicon." Previous to introducing the reader to the description of the scientific and mechanical construction of the instrument, it will be necessary to state that an instrument, on a similar construction, was built by the same firm for the Earl of Kirkwall, at the general per-

formance of which, at a select dinner party at Lord Kirkwall's, the Prince Regent (now his present Majesty) gave his unqualified approbation. This incident gave rise to the construction of the present instrument, the Apollonicon, under the immediate patronage of his Majesty, on an extended scale, which was upwards of five years completing, at a cost of about 10,000*l*. Although this instrument has, at various times, attracted the particular attention of mechanical men, no descriptive account of its mechanical arrangement has as yet appeared, except an account similar to the present, in the "Repertory of Patent Inventions" for the present month; and, as it varies, in many respects, considerably from that of Lord Kirkwall, I apprehend a description of it may be acceptable to the readers of the "Mechanics' Magazine."

It may be as well to observe, that Messrs. Flight and Robson have also constructed organs, for the Rev. Henry Liston, and patented by him, 1810, termed the Euharmonic Organ, of a peculiar construction, (see Philosophical Mag. vol. xxxix. pp. 373 and 414). But as it is not my intention to describe the mechanism of an organ, these are merely mentioned as references; my present business is more particularly with the admirable arrangements of the *mechanical part* or action of the Apollonicon.

In June, 1817, its mechanical action was first exhibited to the public, and in the November following, a selection of sacred music, in memory of the lamented Princess Charlotte, was performed on the instrument by the celebrated Professor Purkis: from this period up to the present time it still retains its well-merited popularity, being also constantly visited by the first musical professors and mechanical geniuses of the age.

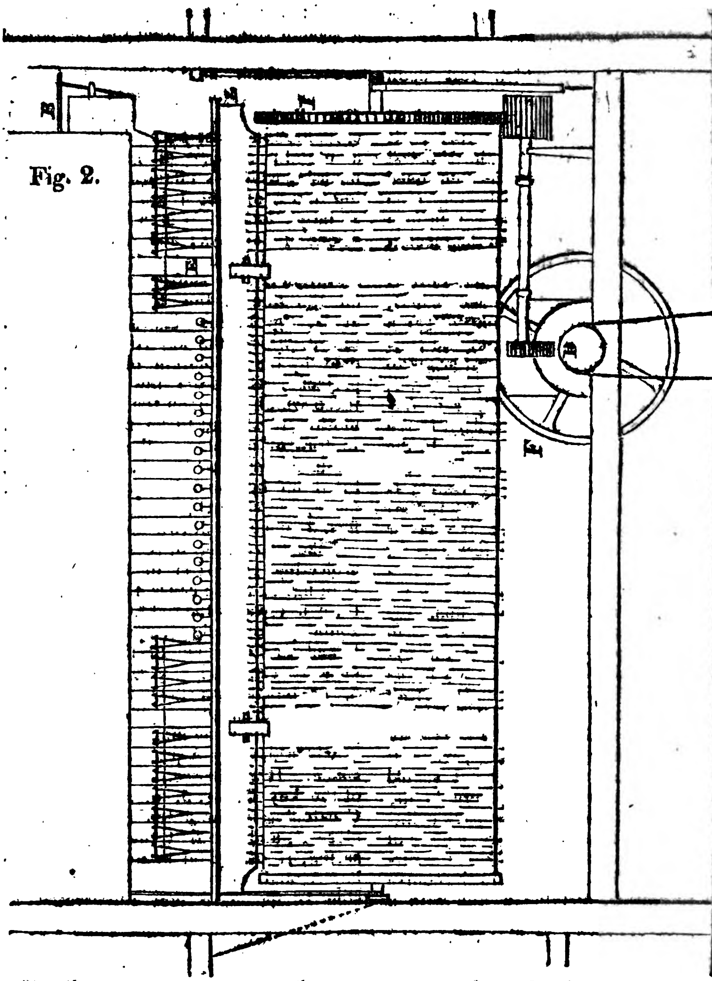
The accompanying drawings have, through the kindness of the inventors, been recently taken from the instrument itself, and from actual measurement.

The most striking of the peculiarities in the mechanic details, are illustrated by the engravings marked from 1 to 5. It is furnished with six distinct sets of keys, for as many performers, if required; the wind is supplied from bellows under the apartment in which the instrument is situated, and is forced up into capacious chambers on each side of the instrument, acting also in the form of bellows or reservoirs (see F, fig. 1); these are furnished with valves, discharging any superfluous wind that may not be required for immediate use: from these the wind is conveyed through square channels, F, fig. 3, to the wind chests, three in number, which lie horizontally above the cylinders, and the wind passes from thence to the groove board immediately in contact with the ends of the pipes, as in other instruments of the organ kind. The power at present employed to give motion to the cylinders, from which the whole mechanical combination of the instrument proceeds, is manual,* and applied at a winch giving motion to a wheel D, fig. 2, round which a strong catgut cord is passed, communicating to a wheel and shaft under the cylinders. This shaft has on its axis a fly wheel F, 3 ft. 6 in. diameter, regulating the motion: this shaft lies from front to rear of the instrument, and is furnished with worm screws acting upon other shafts or axles placed parallel with and under the cylinders; each of these shafts has a toothed wheel of brass on one end, working a larger toothed wheel (also of brass) fixed on the periphery of each of the three cylinders I, fig. 2, thus giving motion to the whole: the cylinders are upwards of two feet diameter, and two of them are 8 feet in length; the short cylinder, working the bass notes, is 3 ft. 9 in. in length.

The instrument embraces, in the compass of its mechanical power, as may be readily supposed, a great number of stops, which stops *are actually worked* through the immediate action of the cylinders, and may be further explained by the following classification: the First extending from the G G, an octave below gamut, or first G in the bass clef, up to G, an eighth above the upper G in the treble clef; in all five complete octaves.

The First Scale comprizes, 1. Open diapason. 2. Do. 3. Stopt diapason. 4. Principal. 5. Twelfth. 6. Fifteenth. 7. Flute. 8. Sesquialtera. 9. Cornet—Trumpet.

* A steam engine was formerly employed.



The Second comprises a scale of notes from G G G, an octave below the G G of the first scale, or two octaves below the first line G in the bass clef, and comprises two octaves up to gamut G, of pipes constructed of wood of an immense size, and are technically termed double diapason pedal pipes: the largest of these measures 24 feet in length, and about 23 inches square! the volume and depth of tone of which is sufficient to produce a perceptible tremor throughout the whole building in which the instrument is placed: to the same scale is adapted a stop of trombone or large reeded pipes. When the keys of the instrument are played upon, these pedal pipes are also under the command of the performer, and are, as their name implies, a scale of notes worked by his feet.

The compass of a Third scale is from the first line G of the bass clef (or gamut G), up to G, the fifth space in the treble clef, adapted for the following stops:—

A diapason or corni' stop. A stop diapason. A violoncello stop. A German flute stop. A wood fifteenth stop. A trumpet stop.

The remaining scales are from G, (the compass of the fiddle and wind-instruments) up to G in alt., an octave above the treble clef, comprising—

Cremonas, flutes, vox humana, octave

flute, hautbois, piccolais, trumpets, diapasons, principal, &c.

The axes of the cylinders revolve upon supports or slings, which rest upon points, and allow them to rock or swing backwards or forwards (represented at B B B, fig. 1): this figure represents generally the end view of the shortest cylinder. On the axes before-mentioned a screw * is cut (fig. 2), having nine threads, being the number of revolutions required for each cylinder in the mechanical performance of the overtures, &c.; a knife or guide (marked C, fig. 1) rests upon the screw: thus, in the revolutions, the cylinders are gradually impelled in a sideway direction, allowing, at the conclusion, the whole of the keys attached to the key frame D, fig. 1, and L, fig. 2, to become disengaged and free from acting upon the staples and pins fixed to the circumference of the cylinders. If the action is required to be repeated, the lever A, attached to the key frame, is depressed, which lifts it (the key frame) from the cylinder, allowing the latter to be thrown backwards or forwards for this purpose. The key frames are further furnished with anti-friction wheels or rollers, E, fig. 1, revolving upon the cylinders, thereby allowing the keys to slide lightly upon the surface of the cylinder as well as guiding the key frame in its proper direction, and relieving all superincumbent weight from off the keys. Now, as it is evident that the keys may not all be in their proper places, when it is requisite that the instrument should perform, for this purpose there is the following contrivance on the back cylinder (fig. 2). Near the centre, a piece of metal projects considerably from the surface of the cylinder, which, in the course of a revolution, striking a key with a cord attached to it, and passing over a pulley near the floor, gives the necessary check or notice below, that all the keys are then in their proper places for the commencement of the action.

Shifting Keys and Stops.

This very beautiful mechanical arrangement requires particular notice, from the fact of its tending, in a great measure, to give that precision in the instrument so much and so deservedly admired: now, for the purpose of effecting a sudden transition from the full power of the instrument to its most piano passages (which might be exemplified by many striking passages from the Der Freischütz Overture), a difficult cross motion must be made to draw off a certain number of stops instantaneously, which is effected by the shifting keys, of which fig. 5 shows one at large, and which is a front elevation of one of the keys; and fig. 3 is a side elevation of the key fig. 5, and a general elevation of the shifting and draw stops on the side of the instrument, taken at B, fig. 2; the staples and pins Q, fig. 3, which the key A has to move over by the revolution of the cylinder, project farther from the cylinder than those which act upon the pipes, as the motion is obliged to be more powerful to draw off or place on the stops. Now, let us suppose the key A, figs. 3 and 5, lifted up by moving over the staple Q, fig. 3, the vertical part of the key R R, figs. 3 and 5, is drawn downwards, and the shoulder C, fig. 5, pressing upon the projecting part H H of the cross piece B of fig. 5, would cause D, fig. 5, to be thrown towards the right, and the horizontal piece E, fig. 5, which is fixed to K and to D, would at the same time cause that and the stop L L, figs. 3 and 5, to be thrown inwards: a reverse action to draw the stops out is accomplished in the same manner, at the period at which the key A passes over another staple. It will be seen that in the middle of the key R, fig. 5, there is a spring G catching in the notch F of the cross piece B, and also that there is a helical spring, I, hooked on to the back of the key A, and fixed also at B, fig. 3. The stop L, fig. 5, is now represented as drawn outwards, and the lever part of the key A will of course be resting upon the *surface* of the cylinder. The reader will now suppose that the stop or slider L is required to be thrust in. If the lever part of the key A were now lifted up by its passing over a staple, the shoulder C would press upon H, and would carry the cross piece B to the other side, along with the spring G, and bending it; thus the stop L would be thrust in, and the helical spring I, fig. 3, would then be first *distended*, and as the lever or key A fell from the staple, would *relax*, and the shifting key R would by this cause rise upwards above the corresponding shoulder H, on the other side of the cross piece B; so that again, when it passed over a staple, a contrary action would be repeated, drawing it out

* The meaning of this will readily be conceived, as it would be impossible, *without a spiral barrel*, for one revolution of the cylinder, in a parallel direction, to be any thing like sufficient for the performance of a lengthened musical composition.

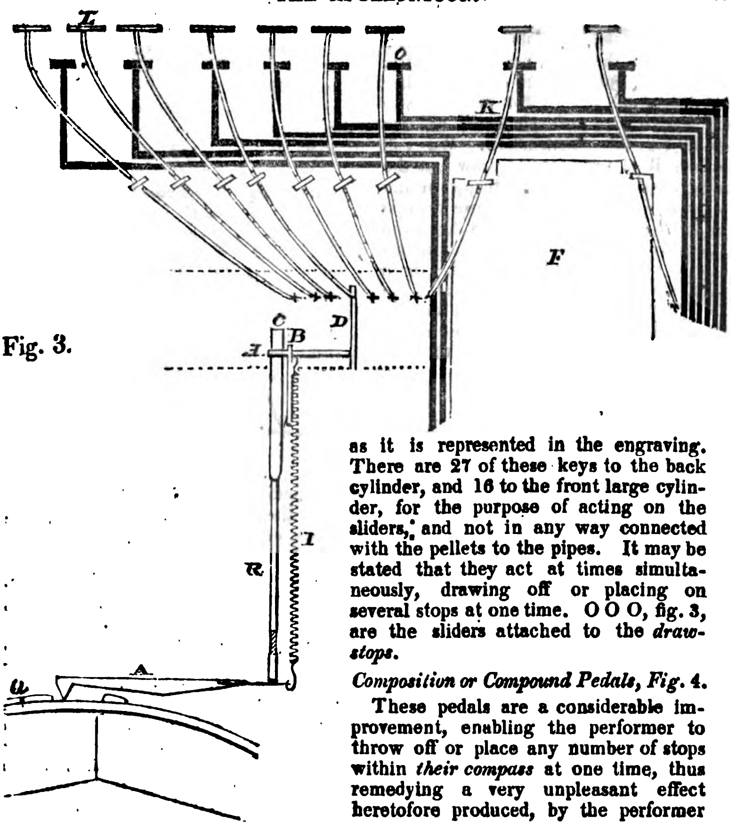


Fig. 3.

as it is represented in the engraving. There are 27 of these keys to the back cylinder, and 16 to the front large cylinder, for the purpose of acting on the sliders, and not in any way connected with the pellets to the pipes. It may be stated that they act at times simultaneously, drawing off or placing on several stops at one time. O O O, fig. 3, are the sliders attached to the *draw-stops*.

Composition or Compound Pedals, Fig. 4.

These pedals are a considerable improvement, enabling the performer to throw off or place any number of stops within *their compass* at one time, thus remedying a very unpleasant effect heretofore produced, by the performer

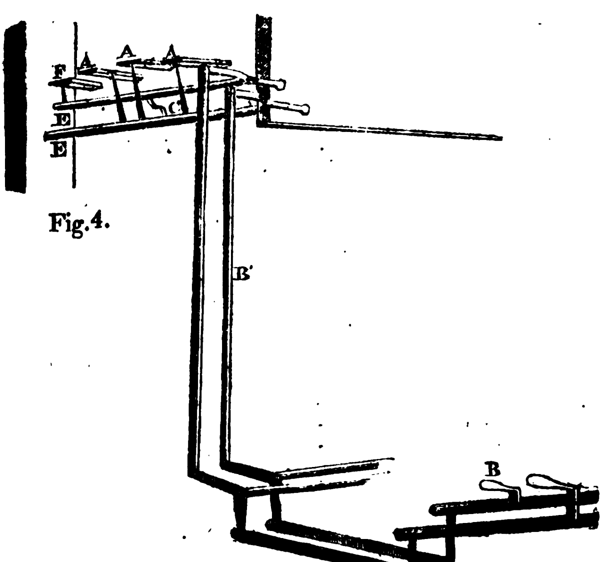
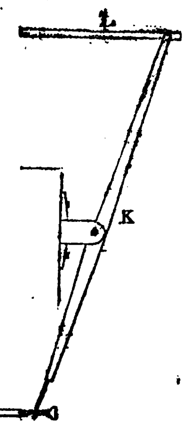
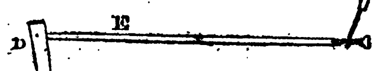


Fig. 4.

depressing several pedals at once, and causing from the noise, not unfrequently, a complete annihilation of the higher and finer notes. Fig. 4 represents a perspective view of the levers of two pedals for this construction. We will suppose it is necessary to draw out the three stops A A A, and throw in the single stop F; for which purpose depress the pedal B, which also draws down the vertical rod B+, and turns the horizontal and circular bar E, with the three projecting prongs of iron, towards the left; these acting in notches on the stops A A A, will also thrust those in the same direction. In the centre of each horizontal bar E E, is a curved tooth of iron: the lower tooth C, in being turned to the left, will act upon *the upper tooth*, turning that in a contrary direction: by this means (as the diagram will show) the three stops A A A will be drawn out, and the stop F forced inwards, and *vice versâ*. It is almost unnecessary to inform the mechanical reader, that different combinations of stops on this principle may be produced, *ad infinitum*.

Fig. 5.





The instrument is furnished with five of these pedals, capable of the following combinations at the immediate command of the performer, and at the same time giving the different changes with the greatest energy and effect.

1st, Is the dulciana alone.

2d, The three diapasons and dulciana.

3d, The three diapasons, dulciana, principal, fifteenth, and flute.

4th, The three diapasons, dulciana, principal, flute, twelfth, fifteenth, sesquialtera, cornet, and trumpet.

5th, The trumpet, and stopt diapason.

There are also four distinct swells on a much improved principle, by which the performers at the keys, in conjunction with the advantages given by the compound pedals, produce a greater degree of musical expression, similar to the effect of the bow on the violin, with a softness and delicacy of tone, which has been allowed by the *dilettanti* in these matters to be superior to that which can be drawn from any other instrument.

Kettle Drums.

In giving additional power and a novel and extraordinary effect to the instrument, two kettle drums are placed in the interior, situated at the back and near the upper part; these are worked in the following manner:—the drum sticks are fixed to each corner of a piece of metal of a triangular form; a wheel fixed upon the fly wheel shaft is made to revolve rapidly, and, being connected to the triangle above, communicates a rapid rotary motion, causing, in each revolution, the surface or head of the drum to be struck thrice, as it is only at intervals or long pauses that its service is required. In grand overtures, &c. they are suspended some distance above the drums, and even if they revolve, of course cannot

act; but when it becomes necessary to bring them into action, a lower triangle is attached by a key to the key frame; which key, in rising upon a staple on the cylinder, draws the upper triangle downwards, bringing it in the proper position of contact with the drum heads.

General Observations on Minor Arrangements.

The whole number of the keys or levers that are acted upon by the cylinders, and command the tones of the instrument, are about 250: the cylinders are three in number, which, acting upon certain divisions of stops and pipes, thus, in their united powers, produce the whole combination of tones mentioned in the preceding enumeration of stops. There are various changes or sets of cylinders; three cylinders form one set, which are necessary for the performance of certain musical compositions adapted to the Apollonicon. There are three sets already completed with the following works:—

Overture to Anacreon, by Cherubini; Mozart's Overture to Clemenzadi Tito; Beethoven's Overture to Prometheus; Mozart's Overture to the Zauber-flote; Haydn's grand Military Movement, from his Twelfth Symphony;

The overtures at present before the public, are, the overture to Figaro, by Mozart; and the Der Freischütz, by Weber. It would be needless here to descant either upon the excellence of the selection for its mechanical action, on the one hand, or the brilliancy of execution, on the other; but certain it is, that in Weber's mystic overture, effects are produced highly characteristic of the composition, and peculiar to the instrument.

There are about *nineteen hundred* pipes in the instrument; two kettle-drums; and forty-five draw-stops belonging to the finger part, for the use of the performers. The front of the instrument has an appropriate and somewhat classical design: the lower portion being decorated by pilasters of a Greek Doric character, surmounted by an architrave cornice.

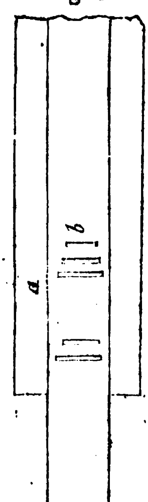
The upper part has four pilasters (Greek Ionic), reaching to the ceiling, 24 feet, with gilt capitals, entablature, &c.; the intermediate spaces between the pilasters being filled by three well-executed paintings, by Wright, of

APOLLO, CLIO, ERATO,
Music, Poetry, History,

—thus combining, with judgment, three of the sister arts, Architecture, Music, and Painting.

Until very lately, it has been the practice to have the sliders for the stops perforated with holes of the same circumference as those placed over the groove board for the admission of wind to the pipes; but this method was accompanied by the inconvenience of moving the slider sufficiently forward to clear the holes; but, by reference to the diagram, fig. 6, it will be seen that

Fig. 6.



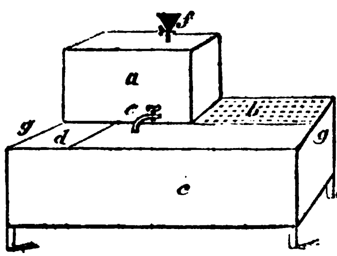
the slider *a* has two, three, or more slits or openings upon its surface, so that a very slight removal of the slider upon the part *b* will be sufficient to throw the stop into its full action, and, in fact, to give, almost instantaneously, the complex nature of the machinery of the *Apollonicon* every advantage in point of *precision* and *delicacy* of tone.

Messrs. Flight and Robson have it in contemplation, for the ensuing season, to set Weber's very beauti-

ful overture to *Oberon* on the cylinders, not only from its rapidly increasing in favour with the musical world, but as affording an opportunity, not to be neglected, for displaying the accuracy with which this intricate composition may be effected by the mechanical powers of the instrument. Mr. Flight, jun. is entrusted with the difficult task of arranging and adapting this masterpiece to the cylinders.

It is my intention to return to this subject, in order to explain the method of pricking the music on the cylinders, by means of a *micrometer* invented by Mr. Flight for that purpose.

PNEUMATIC TROUGH.



Sir,—Above I give you a perspective sketch of a pneumatic trough of my invention, for chemical experiments, for insertion in your improved Publication, if you think it worthy of a place therein. I expect it will be found more convenient than any hitherto made,—certainly more so than any I have ever seen or heard of. It may, of course, be made to any dimensions, to suit the purpose of operators; and any tinman is competent to the task. Its great simplicity I conceive renders any explanation besides the annexed unnecessary.

I am, Sir,
One of your Oldest Subscribers,
BENEVOLO.

Jan. 1828.

Description.

a, a close or water-tight cistern;

b, a perforated plate for vessels to stand on while being filled with gas;

c, the trough;

d, a close plate for vessels to stand on;

e, a cock fixed into the cistern *a*, near the bottom, with a nose long enough to dip so deep into the trough as to keep the water at the required height. This cock should always be open when the trough is in use;

f, a cock fixed on the top of the cistern, with a funnel attached to it, for filling the cistern conveniently. This cock should always be shut, except while the cistern is being filled;

g g; handles might be fixed at these places, for moving the apparatus about.

N. B. The cock *e* would, perhaps, be better *under* the cistern, as the air would pass more easily through it, at the same time that the water was running through it into the trough; and the larger, in reason, this cock is, the better.

THE THAMES TUNNEL, AND GREEK STEAM BOATS.

Sir,—I have examined Mr. Deakin's plan for tunnelling, and I find nothing either new or "excellent" in it. The employment of "iron boxes" was proposed and adopted by Mr. Brunel. Mr. D. suggests what *may* be an improvement, but certainly not an important one: I mean their forming the "centering for the mason-work." Were the proposed object merely to make a hole under the river, going as deep as Mr. D. advises might be accompanied with some good consequences; but other objects are to be attained; and the disadvantages of the plan have already been pointed out ("Mechanics' Magazine," vol. ix. p. 55).

Mr. Deakin must surely be aware of the circumstances which constitute the difference between building a tunnel for the purpose of forming a ready communication between two points, and driving a level for the purpose of getting iron, stone, or other minerals. But is it not possible to find a soil of so loose a nature, that the greater depth would be disadvantageous even while the tunnel was building?

I have already expressed my opinion of the treatment Mr. Brunel has received, and the reasons on which that opinion is formed, in my former letters; to which I refer T. M. B.

I should scorn to attack any man by "inuendoes and indirect means;" nor have I so attacked Mr. Galloway. Of the efficiency of the machinery put on board the *Enterprize*, I believe there is but one opinion. I do not vouch for the truth of the following particulars respecting her; but I had them from good authority, and I firmly believe them to be true; and I here ask Mr. G. whether they *are* true, or which of them he will think proper to deny?

I am told that his boilers contained *oval* tubes, which were soon compressed and rendered useless by the force of the high-pressure steam employed; they were therefore taken out, and the boilers altered; but they would not raise sufficient steam: for which reason, I have heard that they were set in *brick furnaces;* but I think this must be a mistake. However, I am informed that afterwards the cylinders were taken out, and smaller ones substituted: when this had been done, it was *discovered* that there was not sufficient power, and that the paddle-wheels were too deep in the water. To remedy these things, the paddle-wheels were altered; and, after all, there was another alteration made at one of the outports. Can any thing in the annals of bungling be found to equal these stupid blunders, and the astonishing ignorance evinced in the ill-directed attempts to correct them?

The *Irresistible* was not long enough in existence for many alterations to be made in her; but her state is described in a letter in the "Times," of November 1, 1827. It appears that when she started, the steam-gauge stood at 36, the vessel going *four* knots or miles an hour; and in about seven hours the gauge was down to 22, and the vessel proceeding *two miles per hour.* Hence it appears that the steam could not be kept up, even with the assistance of the coals at the sides of the boiler, and the heat of the burning vessel itself. Yet the writer says that "improvements had been made since the sailing of the *Enterprize.*" What *must* she have been, if the *Irresistible* was an improvement upon her!!!

Now, Sir, are we to suppose that all these things arose from such a deplorable ignorance of the profession as their occurrence argues? Or, if not, from what did they arise?

To me it is a mystery how this vessel came to be destroyed; the coals must have smoked for some time before they broke out into a blaze; the burning wood must have cracked and smelt; yet no one found out there was any thing wrong. This is wonderful! And when the fire *was* observed, why was not the vessel scuttled and sunk, instead of being destroyed? Was she suffered to burn, in hopes of raising the steam?

But I believe the whole affair is, and is considered, one of the most •••••••••• •••• that ever came under the observation of the public; and all the parties concerned wish it to be forgotten as soon as possible. I therefore do not expect Mr. Galloway to enter into any defence or explanation, however much he may be pressed to do so.

Yours respectfully,
S. Y.
A Young Engineer.

February 28, 1828.

SEPTENARY SYSTEM.

Sir,—I have no other desire than that any discussion in which I may be engaged should be "tempered with candour and consistency"—indeed, I am not sensible of having deviated from either; neither am I aware of having made any unjustifiable "broad assertions," or of having stated any "fallacious suppositions." I have simply stated *facts* connected with my endeavours to make known the Septenary System, and which I conceive I was called upon to do; and what I have done and stated, is nothing more than justice to the gentlemen who

favoured me with their testimonial in 1823. To Mr. Rice's first letter, I believe I have fairly replied; and as he evidently wishes to drop the discussion, I shall not at present prolong it further, than to state that I have been (certainly not within the last twelve months) in mould-lofts, and know something of the methods of forming curves there; and that I cannot perceive why a solid, mechanically formed, should *necessarily* have no existing geometrical analogy, or why a ship should not be a geometrical solid. A cone, as well as many other solids, may be mechanically formed, and still be a geometrical figure.

I am very far from supposing that a knowledge of the higher branches of mathematics would not greatly facilitate a knowledge of the principles and applications of the Septenary System, and, indeed, greatly extend both. But still much may be understood, and many applications made, without having the high mathematical attainments to which I alluded. And, probably, an intimate knowledge of the several cases of motion which I have enumerated, will enable a person to anticipate any variation of curvature with as much facility as by mathematical analysis; and, certainly, if an instrument be at hand, any line may be drawn in less time than it can be investigated.

The first of your miscellaneous notices (No. 235, page 63,) would imply there is something wrong in the form and construction of English merchant ships.

I shall now leave it to you to state impartially your opinion whether I have done wrong in making public my endeavours; and, from the state of the evidence now before you, whether you think I have received that patronage which such a subject requires.*

I had formed an idea of making a further communication to you on spirals, and intended to notice Mr. Child's when I did so; but as that must necessarily be deferred for some time, I beg to inform Mr. C. that it would be difficult to form a scale of the character of the variation in the examples he has given, as they are on so small a scale. They, however, appear to be portions of epicycloidal lines, produced by the rotation of a large wheel around a small one. If Mr. C. produces these spirals by wheels, I should be glad to know if he can draw another line exactly similar, but of larger (say, double) dimensions, with the *same wheels*.

Mr. C. refers me to his "model for drawing hyperbolas in general;" but that, or any account of it, I have not yet seen.

I am, Sir,
Your obedient Servant,
Jos. Jopling.

* We shall take a review of the whole matter in an early Number.—Edit.

CONSTRUCTION OF FIELD-GATES.

Sir,—I have found, amongst my uncle's (the late Mr. Waistell's) papers, the following observations on gates constructed according to the plan recommended by your correspondent, "*An Ex-Leicestershire Farmer and Grazier.*"

"When in Staffordshire," Mr. Waistell says, "I had many common field-gates made nearly on the plan of that of Mr. Parker's,* in plate I. The diagonal bar, rising from the heel of the gate, meets the middle of the top rail,' as Mr. Parker describes the construction. This top rail is generally made very strong, nearly 3 inches by 4; and yet it is frequently broken off close before the bracing, in consequence of its being strained across at that point by about three-fourths of the weight of the whole gate hanging at the end of the top rail. Faulty as this construction is, we yet see gates upon this plan in all parts of the kingdom. The dimensions of

* Mr. Parker published a pamphlet on the construction and hanging of gates, and requested Mr. W.'s permission to insert his in a new edition. See 22d vol. page 86, of "Transactions of the Society of Arts." I have not, however, seen Mr. Parker's pamphlet.

the heel of this gate, according to Mr. Parker, should be 4 in. by 5—a quantity of timber nearly sufficient for *two* heels of gates. The rails, or bars, are directed to be made tapering from the heel to the head; which is a common method, but of no use in a gate that is sufficiently braced. To resist the pressure of cattle, the rails ought to be as strong at the head as at the heel."

In another paper, I find a calculation of the actual quantity of timber in a six-barred gate, and the several parts are as nearly as possible of the same dimensions as those given by your correspondent. There is also a calculation of the quantity in one of Mr. W.'s gates, from which it appears that it is at least 20 per cent. less than the former.

It may be proper to notice, that a heel 5 in. by 4, contains *more* than double the quantity of timber that is in the one proposed for Mr. W.'s design. The eight five-barred gates to which your correspondent first alludes, failed precisely where Mr. W. describes. If Mr. W.'s gate be constructed wholly of good oak, the middle bars and braces need not be more than three-fourths of an inch in thickness. The other parts also proportionately less. The gate will then be as durable and as strong (indeed much stronger) than the one which your correspondent proposes, if the utmost strength of both were tried in the several positions in which they are liable to be strained.

Besides Mr. Waistell's gate being stronger and containing a less quantity of wood, in the neatness of its appearance it also greatly exceeds that recommended by your correspondent. Of the utility of this latter quality in buildings, Mr. W. thus speaks—"I think neatness in his buildings will be generally found to have some influence upon the farmer—inciting him to a correspondent neatness and accuracy in the cultivation of his fields." And no one, I think, who has seen a large farm or district studded with Mr. W.'s gates, can doubt whether they will not have an equally beneficial effect.

I might say more on this subject, but I confess I do not like to make observations on the communications of a person who does not give his name.

I am, Sir,

Yours, &c.

JOSEPH JOPLING.

P. S. It would be somewhat curious if your correspondent should turn out to be Mr. Parker himself. Since writing the above, I have been some distance from town, where that character of gate which your correspondent recommends, with, however, an additional upright bar, and with a thick and very deep top rail, especially towards the heel, generally prevails. These gates contain above 30 per cent. more timber than those recommended by the late Mr. W.

I could not but observe, that, while only *one* brace is allowed to a *gate*, *two* are uniformly given to a *hurdle*.

ARITHMETICAL CONTRACTIONS.

Sir,—The following contractions are submitted; and if you admit examples, they will appear of considerable use in some questions, which I will endeavour to answer in another fragment of arithmetic.

1. To multiply by any number from 100 to 120, in one line, multiply by the two right-hand figures twice, and to every after product with them, add the back figure, omitting one; then multiply by the left-hand figure of the multiplier the two left-hand figures of the multiplicand.

2. For multipliers not exceeding 12+ or —100, multiply by that difference, setting the product two places to the right. Add or subtract, as the multiplier is more or less than 100.

3. For multipliers ending in 9, use the next number in 0; subtract the unit multiplicand from the unit multiplier; subtract in like manner from every product.

4. For multipliers ending in 1, use the next number in 0; take the sum of the units; to every product add the next left-hand figure.

The following are submitted for improvement to those who have time: they have not been sufficiently exemplified:—

For divisors between 80 and 100, multiply as in Rule 2; then take the sum of the several products and multiplicand. For divisors ending in 1, divide and subdivide, taking the sum of the several quotients.

I am, Sir,
Yours, &c.
E. S. LOCKE.

PATENT CAOUTCHOUC HOSE.

Sir,—In consequence of several applications to me for information respecting the caoutchouc hose, the trial of which (by the London Assurance Corporation) I reported in No. 213 of the "Mechanics' Magazine," I have been induced to lay before your readers the following additional particulars:—The hose which was submitted to the trial above alluded to was manufactured by Messrs. C. Mackintosh and Co. at Manchester; but the hose with which the Norwich Union and British Fire Offices engines are furnished, is manufactured at Fulham, by the patentee, Mr. Hancock; and sold by his agents, Messrs. Pontifex, Sons, and Wood, Shoe-lane, London.

The hose of Mr. Hancock differs from that of Messrs. Mackintosh, in having an internal coat of solid caoutchouc, as well as in the number of folds of the canvas, which, in his patent, are unlimited. Of the astonishing strength of this hose some idea may be formed, when I state that it has been used to form a communication between the boiler and cylinder of a high pressure steam-engine.

Numberless trials have been made of these hoses and in nearly all the instances, some part or other of the fire-engines employed have been broken—in several instances the air-vessel bursting; but the power employed has, on no occasion, been sufficient to cause the least injury to the hose. I make the following extract from a letter addressed to Messrs. Pontifex, Sons, and Wood, by R. J. Bunyon, Esq., Secretary to the Norwich Union Society:—"I beg to state, that the supply (of hose) we had of you about Midsummer, 1826, consisting of 120 feet, has answered its purpose completely, having been in constant use, without ever requiring repair. We decidedly prefer the caoutchouc to the leather hose."

This hose requires no care, no oiling; it has no seams, is of equal strength throughout, and is not liable to crack in the bends as leather does, if dry or neglected. In a word, its flexibility is permanent, wet or dry. These hose possess an unquestionable superiority for ships, warehouses, noblemen's mansions, for parish use, or, indeed, wherever they are seldom used and little taken care of, and yet are required to be always ready at a moment's notice; and it is notorious that leather hose, under such circumstances, can never be depended upon.

For suction-pipes, the caoutchouc hose is invaluable; for to work a fire-engine with effect, it is absolutely necessary that the suction-pipes should be perfectly air-tight; and how few leather ones are so! Any length of the new hose may, however, be used with perfect security. Applied as a suction-pipe to beer-engines, all the evils resulting from the action of the beer on the metal pipes at present in use, are avoided. (See "Mechanics' Magazine," vol. viii. page 205.) These hose have been some time in use, applied to the beer-engines at the Crown, St. Paul's Churchyard; the Red Lion, Shoe-lane; the George, Fulham; and at several other houses in the metropolis: and every person who has used them, speaks of them in terms of the highest approbation.

From the advantages attending the use of the caoutchouc hose, I am inclined to think, that, in the course of a few years, leather hose will be known only by name.

I remain, Sir,
Yours respectfully,
WM. BADDELEY, Jun.
10, *George-yard, Lombard-st.*

OF FALLING BODIES.

Sir,—Your 229th Number contains another letter from G. S. on "Impossible Quantities, and Falling Bodies." To this letter I immediately transmitted a reply, in which I confined myself entirely to the latter of the two subjects, having previously (in No. 225) concluded my observations on the subject of Impossible Quantities. As the receipt of this letter has not been acknowledged by you, I fear it must have miscarried. I shall, therefore, proceed to repeat the substance of the arguments I then introduced as nearly as I can remember; when, if G. S. still *pretend* not to be convinced, he may, with your leave, pride himself in having the *last* word on the subject, as I shall consider it quite unnecessary to take any further pains to explain to *him*, and him *alone*, what he may learn in the smallest work on the subject of mechanics.

First. G. S. *accuses* me of giving *my own rules*. Let him, and those of your readers whom G. S.'s letter may have succeeded in puzzling—let them, I say, compare *my* rule, which he has quoted at page 404, col. 2, with the following extract from Dr. Wood's "Mechanics," Prop. LX. Art. 248, page 143; when $m =$ the space fallen in the first second, S the space fallen through in the number of seconds T—the space fallen through in T," reckoned from the beginning of the motion, is $m\,T^2$ feet.

For $S \times T^2$, therefore $1^2 : T^2 :: m : m\,T^2$, the space described in T" that is, $S = m\,T^2$.

If G. S. will compare the above with *my* rule, he will find that it *exactly* agrees with it.

Secondly. G. S. disagrees with me when I say that "no body falls through 16 feet in the first second in the open air." I crave his attention for a few moments, when I hope to make the point as clear as the preceeding. In the 142d page of the work I have just quoted, I find the following observations:—"Every body, which falls *freely in vacuo* by the force of gravity, descends through 16 1-12th feet in one second." And again: "Every thing relating to the descent of bodies when they are accelerated by the force of gravity, *supposing* the motions to be *in vacuo*, may be deduced from the foregoing propositions." From the *guinea and feather experiment*, it has been ascertained that a feather falls in a vessel voided of air through the same space in a second as a piece of wood, or even a piece of gold, and that this distance is 16 1-12th feet. But in the *open air*, the wood falls with a less velocity than the guinea, and the feather slower than the wood: and neither of them fall so fast as they did in *vacuo*. Hence, "*although no body*," &c. Q. E. D.

Cor. 1. Hence, the *New Light System is* something else "but pretended axioms, and unsupported assertions," *malgré* the *note* at page 404, col. 2. Q. E. D.

Cor. 2. Hence, "If Dr. Hutton's Theorems be true, the whole of the New Light System of the laws of falling bodies does *not* fall to the ground." Q. E. D.

Cor. 3. Hence—but never mind—it must be too evident to need being pointed out.

And now, Mr. Editor, adieu to *this* subject.

I am yours, &c.
HENRY OTTLEY.

Feb. 9, 1828.

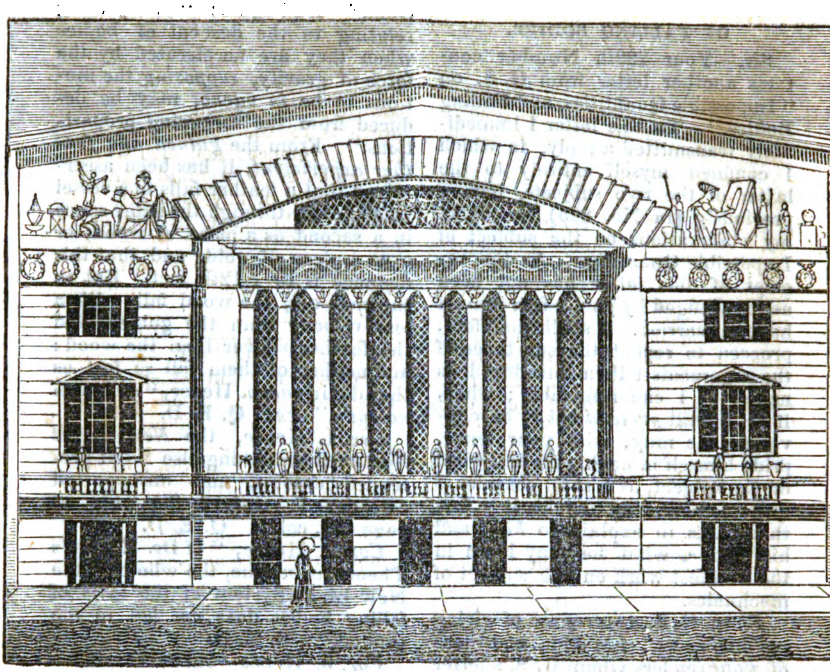
FIRE ESCAPES.

Sir,—In the article respecting fire escapes, which you were kind enough to insert last week, there is an error in the drawing, which it would perhaps be worth while to correct.

Your draughtsman, misled, no doubt, by the obscurity of my sketch, has not delineated the *overalls* correctly. They should be continued below the foot, and terminate in a strong leather sole; the object of which is to bear up the weight of the descending body, and also to protect the feet on coming in contact with the ground.

I am, Sir,
Your obedient Servant,
P.

Monday, 10th March.



The investigation into the causes of this catastrophe is still going on before the Coroner of the district in which the Theatre was situated, and is likely to last through several weeks. From the extraordinary interest which it has excited—(an interest not to be wondered at, considering that, but for a fortunate chance, the accident might have happened during the time of a performance, when the loss of life would have been a hundred times greater than it is)—from the variety of practical information that is certain to be elicited, and the probability that more than one lesson of great and lasting utility, not only to the public, but to architects, builders, and mechanics in general, will result from that investigation,—we are persuaded our readers will not grudge our putting them to the expense of an extra sheet this week, that we may have room to lay before them the more material parts of the evidence adduced.

Before entering into the details of this inquiry, however, we shall first give a general description of the Brunswick Theatre, such as it was for the brief space between its completion and destruction.

It was built in the form of a parallelogram; one of the larger sides of which, situated towards Well-street, made the principal elevation, as represented in the above engraving. Two grand piers on the flanks, surmounted by groups of the *Genius of dramatic literature*, and of *dramatic painting*, were connected at the top by a bold segmental arch. In the recess between these piers stood a lofty and extensive row of pilasters opening upon a balcony, which extended along the whole front. Above the entablature, the front rose to a very considerable height, and terminated simply with the sloping lines of a pedimental outline, without parapets or blocking courses. The intervals of the pilasters were filled with massive bronze treillage, studded at its intersections with pateræ. The capitals of the pilasters were original designs, and each contained a theatrical mask.

On the balustrade, or parapet of the balcony, was a series of statues and vases. Beneath the shelter of the balcony were all the entrances to the different parts of the theatre; every one being entirely distinct from the others.

The distribution of the interior, by which an area of stage nearly equal to the largest theatres, and many attendant conveniences, were obtained upon a site of comparatively small dimensions, is described as having been extremely skilful. Before the curtain, the most striking novelties were the beautiful contour of the auditory; and the arrangement of the seats in the pit. The first was nearly the form which the vertical section of a tulip would give; it presented a very elegant curve, and sweeping round the centre, gracefully and conveniently expanded as it approached the proscenium. The seats on the boundary of the pit, instead of being straight lines parallel to the others, and descending an inclined plane behind the ends of the orchestra, followed the curving outline of the box-fronts, and continued upon a high level through their whole circuit.

The interior was prepared to receive two thousand persons, and was distributed into a pit, two circles of boxes, and one of the largest galleries in London. Each had its own distinct vestibules, staircases, water-closets, saloons, and places of refreshment. The principal parts of the Theatre were rendered incombustible; and to provide and preserve in constant readiness powerful means of raising and distributing an ample volume of water over the whole interior, a fixed engine, connected with a well beneath the stage, was contrived to send the water to a point in the middle of the front of the stage, from whence it might have been directed to play upon any part of the interior in about three minutes from the first alarm. All the stairs, staircases, passages, and vestibules, between every part of the spectatory, and connecting it with the street, were fire-proof; and were of such ample dimensions, as to have held the whole of a crowded house perfectly safe, even if the rest of the building, stage, &c. had been in one general conflagration. This also afforded great convenience to the persons awaiting the opening of the doors previous to the commencement of the performance; and such were the conveniences of a rapid exit, that the contents of any one part of the house might leave by any of the accesses of the other three, or by all of them at the same time. The warming and ventilating apparatus of Mr. Sylvester, so highly eulogized by Capt. Parry, and noticed in our 7th volume, had been fixed under his direction; and other peculiar arrangements and means suggested by him, had been adopted by the architect.

The total cost of the Theatre is said to have been not less than 20,000*l*. The first stone was laid in August last, and *within seven months it was completed.*

THE ENQUIRY,

Before Maurice Thomas, Esq. Coroner for the Tower Hamlets, &c. and a Jury of Neighbours.

March 5.

Mr. George Pound, of Hoxton, in the county of Middlesex, bricklayer, called and sworn, deposed as follows:—When the walls of the theatre were up to receive the roof, they were perfectly upright and safe. After the roof was on, witness had nothing further to do with the building, except the getting up of the parapet, by order of the clerk of the works and the surveyor. After the roof had been put on, there was a great weight hung to it, which, in witness's opinion, was the cause of the accident. He was employed to build the theatre, by the deceased Mr. Maurice, and Mr. Carruthers. Used to go by the orders of the clerk of the works, and the surveyor or architect. The clerk of the works was Mr. Edward Shaw. He first began to build the foundation of the theatre on the 2d of August. There was one written paper, in which witness stated the prices of the various works in his department (the brickwork and scaffolding). Always conformed himself to the specification contained in that paper. Finished all his part of the building a little after Christmas. The parapet was then finished. A great mass of brickwork was built after that time in the area of the interior of the theatre. The walls were fit to

receive the roof in the month of September. Mr. Shaw and Mr. Whitwell were the persons who saw that witness performed his part of the contract with propriety. Mr. Shaw never left the works one day during the building. Mr. Whitwell used to come occasionally three or four times a week, to see that witness was doing the work properly. Is certain that at the time the walls were finished they were perfectly upright. Surveyed them after the roof was on, and they still remained upright. A great weight was afterwards hung to the roof, consisting of the machinery and the workshop. Two girders were put into the walls, and strapped up to the roof to support the shop; they were slight, but cannot depose as to their scantling. They bore at each end in the green walls of the roof. They were put in just lately before the building fell. The heavy weight of the building was at the end. The carpenter's shop and the weights were not, witness believes, the cause of the accident. Heard that it commenced at the flies. Considered the walls safe; left them under that impression. Is of opinion the accident was owing to the great weight suspended from the roof. Had it not been for the weight, thinks the walls would have supported the roof for a century. Did not work according to the paper, which is called the specification, but worked immediately according to the directions received from the clerk of the works. Worked solely by the directions of the architect and his clerk, and by no written instructions. Worked by measurement, and at a certain rate. Never examined the walls internally. Did not think it necessary; because if they cracked inside, the injury would be visible on the exterior: the walls were two bricks and a half in thickness; towards the parapet they might have been thicker, as they had gutters to support, which were intended to carry off the water. The portico was of great weight, and had no support from pillars. Did not form any conclusion as to its effect upon the building, but it was notoriously of a heavy weight, and bearing upon the wall: the portico was solely attached to the walls by cast iron levers; the wall was, from the surface of the pavement to the piers underneath the portico, about three bricks thick, and beneath the pavement, it was three and three-quarters, and laid in cement. Above the portico, to the underneath of the iron plate inserted in the wall for the support of the roof, it was two and a half bricks thick. When the building was begun, there was a wall of about four feet in thickness, which they worked upon; all the other walls were of the same thickness. When the part of the wall from the pavement was formed to the denseness of three bricks, a chain of bond timber was placed on it; and the wall above that bonding was less in thickness, by half a brick, than the former. Stock bricks were made use of throughout the building, with the exception of such of the old ones of the former theatre as were proper to be made use of. There were about 60,000 of the latter carted away as rubbish. All the bricks were not stocks or picked; those that were consumed were of the best materials. Paid 1*l*. 10*s*. per thousand for them in the field: there were not many bats among them. The mortar was composed, throughout the work, of gray stone lime, purchased from the Medway Company, and with this was mixed sharp sand. Is confident it was mortar of an excellent quality. The top of the wall was very dry; the parts under the roof were as dry as could be expected in two months, down as low as the chain plates. After the roof was put on, it was a bad time of the year for mortar to settle, it being winter. The walls were, however, properly cemented; five courses of brickwork round the top of the building were laid in a cement, and afterwards were cemented over to form a coping. The lower parts were worked in cement up to the pavement. Worked upon the old foundation, which was a famously good one. Worked from the top of that to the height of four feet in cement. The two end walls were not built in cement; because the old walls had not been pulled down below the surface. A considerable portion of the front of the theatre was built with piers and openings. The piers were three feet wide, being 2½ feet in thickness, and were in height from 20 to 30 feet, and extended from the porticos to the underside; and were covered over with Yorkshire stone, forming an arch, and cramped in the centre with iron cramps and lead; the dead arches, which were turned over, were worked in mortar.

Juror. Have you seen the sewers and examined the bricks, and can you account for their being clear from mortar?

Yes; I think that might be caused from the shake in falling, as the mortar had not sufficient time to dry. At this season mortar will not dry.

Did you consider the season a proper one for the erection of such a building?

Certainly not for the portico. We had a great deal of frost when the porticos were finished.

[Continued in Supplementary Number, 230.]

Were there bond timbers in the front of the building?

Yes, in the front, at every four feet, to bind the pieces. That chain went round the building, with an angle tie at each corner.

Was there brickwork placed within those pieces afterwards?

Yes; when we were directed, we put about nine inches, I think, and left some openings.

Were the bond-timbers ever cut?

I cannot say. I don't think they were; but my foreman can tell. He is in the hospital, having been wounded in the accident.

I ask you again, whether you consider that season a proper one to go on with the building?

I am of opinion the brickwork under the roof was perfectly safe, but the weather being wet when the parapets were made, was against it.

Did you consider those walls safe when you carried them up?

I certainly did.

How do you reconcile that with your observation, that one part of them was unsafe?

The lime was hot, and the bricks were dry, and the materials were properly applied.

Did you consider, when you examined the flies and carpenter's shop, that they were unsafe, and that appending them to the roof endangered the building?

Yes, I did always: the weight was too great for the roof, and it ought not to have been loaded in that manner.

How was the gallery supported by the timbers? were they affixed to the external walls?

Oh, dear, no, Sir: the timbers had no bearing on the external walls; the interior fittings of the theatre were independent of it. The boxes and gallery were supported by piers of brick.

Cross-examined by Mr. Comyn, barrister, who appeared for the widow of the late Mr. Maurice, and Mr. Carruthers. The flies were not put up until after the walls were erected. The flies contain a great number of joists, and they are put at different distances close together. The apertures or holes cut in the walls to receive the joists would do it no good, but they were filled up as fast as they were made. The smallest thickness of any part of the wall was twenty-two inches (two and a half bricks). He did not recollect any part of the wall being less than that. The external walls were finished at the latter end of September or October. The parapet wall was above the roof, and was finished in frosty weather. That had nothing to do with the roof, it was above five feet from the gutter of the roof. The gallery was supported from the foundation by iron pillars; the boxes were also supported by iron columns. He made two or three alterations in the carcases of the building, such as putting in flues, which were well lined with mortar. All the directions which he received from first to last were from Mr. Whitwell, and Mr. Shaw, the clerk of the works.

Mr. James Arding, Dorset-street, Fleet-street, carpenter, deposed as follows:—Entered into a written contract to do the carpenter's work of the theatre for Mr. Maurice and Mr. Carruthers. The contract produced. It provided that the work should be executed in a substantial manner. Witness ceased to be the carpenter in October last. After that period he was but the joiner.

March 6.

Mr. George Pound called, and re-sworn. Proved that the scale of work and articles of agreement or contract entered into by himself for building the walls of the theatre, and Messrs. Maurice and Carruthers, now produced, was the same he had alluded to in his evidence of yesterday.

This was read by the Coroner's clerk. Its conditions were as follow:—

1st. The work to be performed in the best and most workmanlike manner.

2d. All the materials to be of the best quality.

3d. Witness to supply all scaffolding, &c.

4th. Any work badly performed to be removed, and re-performed at his expense.

5th. He was to supply the men.

6th. The work to be surveyed, and if not approved of, altered.

The other conditions as to the work were of a similar character, and witness bound himself to complete all his contract without any further expense, trouble, or inconvenience, attaching itself to the proprietors.

Coroner. Now, Mr. Pound, tell me whether your prices stated in this specification could ensure the best materials?

Yes, Sir, most assuredly.

Mr. Pound then, in answer to a variety of questions put by jurors, said that the work was carefully done: he had a fair living price for his work. The

mortar was of the best description. He had carefully examined the building every day. He saw it for the last time on the Saturday before the accident, and every thing was in correct order then. He saw no "settlement" in the walls; the brickwork was fair and proper for such a theatre.

Cross-examined by Mr. Hill, barrister, for Mr. Whitwell, the architect. All the walls were finished and sound. They were up and finished *before* the cold weather began. Every opening in the walls of the theatre was formed upon an inverted arch, to give additional security. Those arches were under the piers and the front of the building.

Mr. James Arding called and re-sworn.—The clerk of the works directed where the chain-bond timber was to be put in. It was put into the wall generally at distances of 3 feet 6 inches apart. As the four walls proceeded, ties were put from the back to the front, to the number of nine, with braces and struts, and ties were introduced from 10 to 12 feet, dove-tailed upon the chain bond. The size of the chain bonds was 9 inches by 6, and that of the flies 14 inches by 4½ to 5; the braces and struts were 5 by 6 inches. There were many other braces and struts used horizontally in other parts of the walls, to steady them. Witness had centres for the openings made in the buildings: as far as regarded the concern, he had now stated all that he had done. Mr. Shaw afterwards undertook to erect the stage, the rooms beneath, the carpenter's shop, and the flies above. That arrangement took place about the early part of November. Mr. Shaw was to employ his own men. That portion of the building comprised the whole of the flies, and Mr. Shaw did that work. Witness prepared the floor-boards.

March 7.

Mr. James Arding re-examined, deposed as follows:—When the floors of the stage were completed, one end of the flies was supported in the walls, the other framed into a trimmer; and the former was supported by struts from the stage floor. The painter's shop rested upon the flies. The carpenter's shop had guides resting in the walls, and was suspended, by bolts and iron straps, from the roof. There were two tiers of flies, one over the other. The distance in height between the flies was about 7 feet. The floor of the painter's shop was supported by resting on the second tier of flies. The length of the joists which supported the floor of the painter's shop, was from 30 to 34 feet, and the joists were about 12 by 3 inches thick. The floor of the carpenter's shop was supported by the girders, the ends of which lay in the walls of the theatre, having suspension iron bolts and iron shafts. The bolts from the roof went through the centre of the girders, and in the iron ties of the roof were placed long pieces of timber. The bolts from the girder of the carpenter's shop were connected with the roof by iron nuts and screws, and in some places strapped. There is this distinction between bolts and straps—the former are attached by nuts and screws, the latter lap over. The bolt which goes through the girder of the carpenter's shop goes up to the pieces of timber, and was fastened with a nut and screw, and an iron plate which is called a washer.

Coroner.—Were the nuts countersunk in the timber, or screwed home on the plates?

I speak from what I afterwards saw; I think the nuts were not countersunk.

How did the iron roof rest upon the building?

Upon the four walls.

Describe in what manner the ends of the roof rested on the walls.

On the wall plates; the plates really formed one continued plate, consisting of several pieces of timber fastened together. The roof rested on those plates. I should rather say the plate, for the four walls are technically considered as one wall, and the plate goes round the walls: the roof rested on the said plate, which was simply laid on.

Juror. Was it secured in any manner to the wall?

The plate was simply laid on.

Further examined, deposed that the roof was hipped—bedded in mortar. The iron ties were composed of pieces of wrought iron put together; they were not rivetted, nor bolted, but rather like grappling. The gutters ware of cast-iron. Does not think the bolts from the painter's shop to the carpenter's shop afforded any support to the carpenter's shop floor. The pit was constructed thus:—A circular wall went to the back of the pit, upon which rested cast-iron girders, from which sprang brick arches, over which were joists, flooring boards, and seats, which formed the pit. The flooring boards were inch-and-a-quarter Christiana deals. Thinks the pit was properly supported in all its parts; very much so indeed. I saw them put up. The joists of the pit were Dantzic timber; they differed from 6 by 2½ to 9 by 3 inches, according to their different bearings.

Being asked how the boxes and galleries were supported, deposed, that the support for the boxes rested upon a brick wall; the circular one before described in the pit at one end, and the other end resting on wrought-iron columns standing on brick piers. This was the first tier of boxes. As to the second tier of boxes, one end rested on the circular wall as before, the other end rested on wrought iron columns standing above the ones before described. The gallery was supported in a similar manner, the principal timbers of which ran over the circular wall to the main walls of the building; the wrought-iron columns were continued through the gallery to the under side of the girders to the carpenter's shop. The brickwork in the interior stood upon its own base; the principal timbers of the gallery and boxes had no tie to the walls. There was no connexion between the brickwork erected in the interior of the theatre and the external walls. Does not consider a chase in the wall a connexion. The principal timbers that supported the galleries were let into the external walls. Is of opinion that the galleries and boxes were safely and sufficiently supported. The iron columns running from the boxes to the gallery were amply sufficient to support the weight. There were four posts in the building, which witness understood were called Proscenium posts, into which the trimmers of the flies were framed in the centre division of the house. Those supporters were made of timber. They were about 40 feet long each. Each sprang from a wall which was built for the front of the stage, and the two back ones from brick piers, brought up from the bottom or foundation of the building. There were two in front and two in the back of the stage. They stood erect. They were about 12½ inches square. They were not circular. These pillars stood erect; the trimmers were framed into them, and those supported the flies. The first fly had a trimmer that went into the proscenium posts, and was there secured. The same applies to the second fly. The girders of the carpenter's shop rested on the tops.

Mr. Comyn. Upon your judgment and experience, did the joists of the flies which were let into the external walls injure the building?

Yes.

In what manner?

The walls were perfect before these joists were let in, but the insertion of the joists after, which were cut into the walls, I am of opinion, mutilated the walls.

What, in your judgment, was the cause of the building falling?

(Pausing.) I cannot form an opinion of the cause of the theatre falling.

How were the joists of the flies fastened into the walls?

They were simply let into the walls, and rested upon them.

Had they any plates or anything else to fasten them?

In some cases they had pieces of timber from the openings. Between every opening of the front walls, as far as the flies go, a piece of timber of about 9 by 6 was was introduced or laid in from pier to pier. This was a peculiar building from beginning to end. The timbers so laid in from pier to pier in the front wall only were in every case about 3 feet 6 inches. The timber was Dantzic. The back wall was larger.

In letting in joists into walls, is it usual to have them fastened by iron or any other ties?

I never saw before, a floor let in in the way I have before stated, as regards the joists of the flies.

You described the iron bolts to have been let through the beams of the trimmers and girders of the flies and carpenter's shop, and connected with the roof by straps; in your judgment do those bolts which connect the carpenter's shop affect the roof?

Yes.

In what manner did they affect the roof?

In my judgment, as a practical carpenter, I have always understood that the tie of a roof is for the purpose of preventing the spreading of the roof itself; —I mean the preventing the spreading of the foot of the rafters. A weight placed upon the tie of a roof must necessarily tend to pull the roof within the walls,—I mean the walls which support the roof.

In your judgment, was there such a weight from the carpenter's shop, the painter's shop, and the flies, as to produce the effect you have just described?

In my judgment, there was *not* such a weight from those parts as to produce that effect, so long as the uprights which I have before described from the stage to the flies remained.

In your judgment, did those uprights prevent the weight of the flies so long as the uprights remained—did that prevent the dragging or drawing on the ties of the roof?

Certainly.

What is the utility of passing the bolts and straps through the trimmers from the workshops to the roof?

To connect the floors the one to the other.

Supposing these bolts had had no connexion with the roof, the external walls were of sufficient strength to have supported the floors to each other?

In my judgment, it is so.

Do you know of any other weight, of your own knowledge, being put on the roof, other than the iron gutters?

The slates, the lead hips and ridges, and the skylights. I do not recollect any other.

How long before the opening of the theatre had you discontinued your work?

I had some persons actually working there when the theatre fell in.

When at the last time, or before, you were at the theatre, did any thing occur to call your attention to any apprehension of danger?

None whatever.

Do you know whether any of those uprights which supported the flies had been taken away or removed before the accident?

I do not know the fact, of my own knowledge.

Juror. Were those long bond timbers that ran through the long openings cut out?

There are nine long openings, and they were not cut. One inch, and in some places one inch and a half, had been cut away, to have the plastering done; but plastering will not affix itself to solid timber. The bond timbers remained up at the time of the accident.

A Juror. Were any portion of those uprights or struts alluded to by you removed?

Not to my knowledge; strut is the timber in its rough, and it is an upright when planed.

Mr. Hill, for Mr. Whitwell. Did you receive any directions, or did any of your workmen receive any, respecting the stage, the two workshops, or the flies, from Mr. Whitwell.

No.

Were there not bolts and straps connecting that part of the floor of the carpenter's shop with the roof, which was nearest the gallery?

Yes.

Is it your opinion that the weight of that part of the carpenter's shop which was next to the gallery had no support from the uprights on the stage?

Yes, most certainly.

If the uprights upon the stage had been taken away, and if the number of columns had been fewer by two in the gallery tier than in the box tier, what, in your judgment, would have been the cause of the accident? What would have been the effect of such removals and omissions?

The effect would have been, in my judgment, that the weight of the two tiers of flies, the painter's, and, in a great measure, the carpenter's shop, would have to depend for support upon the roof.

Was the throwing of such a weight upon the roof a fair and proper use of that roof?

Decidedly not.

You say the weight upon the roof was borne by the ties?

Yes.

Does it appear to you that, if it was thought proper to throw weight upon the roof at all, such weight should have been thrown upon the principals of the roof, and not on the ties?

Certainly.

What would be the effect upon the ties, by throwing the weight upon the ties?

It draws the tie down, or "bellies" it.

If the ties bellied down, would not a great weight be thrown on the girders of the carpenter's shop floor?

Yes.

Where would the girders break in that case?

At the parts nearest the bolts.

Suppose a girder to have broken near the back wall, would it (the broken girder) not become a long lever, to prize up the upper part of the front wall?

Yes.

You have described the effect of the girder prizing up the upper part of the front wall; what would be the effect in the event of the wall falling?

If it was a parallel wall, it might have fallen inwardly; but here it was a pediment, and I cannot say it would have the same effect.

Could not both ends of the joists of the flies in the interior have been supported by a trimmer (or pillar) at each end, instead of one end of them being let into the wall?

Yes.

In point of fact, the joists of the stage were supported on breast swimmers and vertical posts?

Yes.

You said you prepared part of the boarding for the carpenter's shop; did you prepare any part of the girders?

No, Sir. I believe I had an order about five or six weeks before the house opened for four or six trusses, from Mr. Shaw, the clerk of the works; but they were countermanded, and the foreman brought the message.

What was the use and object of those two pieces of timber?

These trusses were for the carpenter's shop. The object of a truss is to let it in between two pieces of timber, for the purpose of strengthening those pieces.

If those trusses had been erected, would not they have strengthened the girders, and consequently the floor?

Yes.

Mr. Comyn.—Look at that paper, Mr. Arding, and tell me whose hand-writing it is?

Mr. Arding.—It is Mr. Whitwell's hand-writing.

Mr. Comyn said it was an important document, and Mr. Brown read it at length.

"Memorandum of an agreement made this day, the 22d day of June, 1827, between Messrs. Carruthers and Maurice, proprietors of the site of the late theatre in Well-street, Wellclose-square, Goodman's-fields, and Stedman Whitwell, architect, relative to the services and remuneration of the latter during the erection of an intended theatre on the said site.—Mr. Whitwell is to design, prepare the plans, and superintend the erection of the intended theatre, as the architect of the same, for the sum of three hundred pounds, to be paid by monthly instalments of 50*l.* each; the first payment of 50*l.* to be made on Monday, the 2d day of July next, and each following instalment to be paid on the first Monday in each succeeding month, until the whole sum of 300*l.* be paid. Mr. Whitwell engages to give his most zealous attention to the interests of the proprietors, to reduce the cost within the limits of a wise economy for the above remuneration; but if he lays before the proprietors any arrangements by which security from fire, ventilation, and warmth, can be obtained, which are unusual in theatres, and the proprietors adopt such arrangements, then the proprietors will feel that Mr. Whitwell will have claims upon them for additional remuneration, the amount of which Mr. Whitwell leaves to the honour of the proprietors—and if the works in his direction should be completed for less than the sum of 6,000*l.* then for each 100*l.* less than such amount, Mr. Whitwell is to be paid 5*l.* by the proprietors. All expenses of clerk of the works and measurer are to be defrayed by the proprietors, but during the hours of work the clerk of the works to be under the direction of Mr. Whitwell. Mr. Whitwell is not to be required to design any of the works of or relating to the internal decorations, the stage and its machinery, the scenery or the orchestra; but he is to superintend, at the request of the proprietors, the parties who may be appointed by them to construct the same. The cost of these works not to be considered any part of the 6,000*l.* before-mentioned.

"STEDMAN WHITWELL."

March 10.

Edward Shaw called and sworn, deposes, *inter alia*, as follows:—On the 2d of August we began the works. Mr. Carruthers told me that I was to consider myself as clerk of the works, under the direction of the architect, Mr. Whitwell, who ordered me to have the whole of the foundation round to be carried up two courses above the level of the pavement in cement. I believe there were seven openings to be left in the walls, two large ones about 11 feet 7 inches wide, the other five were 4 feet 7½ inches. Mr. Whitwell ordered me to be correct in having "inverts" (inverted arches) "in every opening." At about 9 feet high we began the first tier of chain bond, but that only went round the south end and the west side. There was on the other side an old wall, and bonding was not there necessary. From that the bond was continued every four feet, until we got to the long openings in the front. In the front there was a course of stone, which projected, to form the cornice above the opening. From that to the plate round for the shop floor was about five feet and a half distance. The next tier of bond was about six feet. From that to the plate (where it was to receive the roof) was about seven feet distance. The walls were up to, and for two courses above, the pavement, three feet and a half thick; they were also cemented. From that level it was set off to three bricks, which were carried up for nine feet six inches. In the centre, where the small openings were (in the front walls), there was a set-off of half a brick until such time as they got to the stone coping. Then it adjoined the sets-off from the openings from the piers below, to bring the wall to its regular thickness. From the stone coping to the plate of the shop-floor, half a brick was added, thickening the wall to three bricks. The wall continued from the

plate of the shop-floor to the plate under the roof (the wall-plate) of the same thickness. I am now speaking of the front wall. The south end wall and the west wall, and the back, were two bricks and a half thick. From the pavement, to nine feet six inches high, they were three bricks; but from that height to the roof, they continued two and a half bricks thick regularly round. I know of no alteration in the thickness of the walls in the parapets, excepting that we made an oversail where the gutters came of about five inches towards the west wall, and two inches in the front, to save the walls from the wet. The entire height of the front wall, from the pavement to the parapet, was from 75 to 78 feet; up to the plate, it was 60, and above, to the point of the pediment, about 17 or 18 feet. The number of old bricks used might be from 130,000 to 140,000; they were chiefly used in the interior. The only new bricks that I saw brought on the premises for the exterior walls were second stocks. Mr. Pound told me stocks could not then be got. The mortar used in the external work was quarry-stone lime, and river-sand. Some call it sharp sand. At times, in arches, and things of that kind, when the openings were covered over, we used cement. The generality of this building had not thick wall-joints, *i. e.* had not too much mortar between the bricks. It was not scamping work, but the walls had what was called good wall-joints. All the mortar was mixed in a pugmill. No old bats were used in the external walls. Half a brick is a bat. Few of the old bats were used in any walls above the earth; they were mostly sunk in the foundations. What were used above ground certainly did not affect the security of the building.

The Coroner. Now proceed, and tell us what you did in the carpenter's work of the theatre.—Did you superintend the erection of the stage?

I can't say that I did; for I was not allowed to have my own way.

Who prevented you?

The proprietors, Mr. Carruthers and Mr. Maurice. After a day or two (having felt offended), I was allowed a little more authority. The new power given me was by Mr. Maurice. I had been compelled to take off my coat and work like any other man, which I considered bad treatment.

Coroner. Proceed now, in your own way, to tell us how you proceeded with the rest of the carpenter's work in the interior of the theatre?

After erecting the stage, we got up two tiers of flies, and then the proscenium posts. The carpenter's and painter's shops were then put up. I had no working drawings given me for the flies and shops. There were four flies. Two on the P. S. and two on the O. P. side, each of which was supported by three uprights. The bottom upright went from the stage to the trimmer of the first fly; the joists were inserted in each wall. The footing of the upright stood on a trimmer lying on the joists of the stage: the quarter partition underneath took the support of the stage, and that rested on a brick-wall, carried up from the foundation. The quarter partition was framed in the plates that rested on the wall, about 9 feet high from the foundation. It was a 9-inch wall. In different parts it had piers of 14-inch work: all along the front of the wall I speak of was 14 inches (thick). The joists of the first fly were inserted in each wall, after the building of such wall. The next erection over the flies was the painter's room, which was within six inches of being level with the second fly. There was a model which had been made by a Mr. Price, under my directions; but it was destroyed by the falling of the building. That model comprised the stage and the carpenter's and painter's shops. As we proceeded, I used to consult it. I made it for the purpose of setting scenery in it to try the effect, and likewise to show to the proprietors the plan by which I intended to hang every thing in that department. I was prevented acting by that model by Mr. Carruthers.

By one of the Jury. You said you were denied access to that model. In your judgment, were such denials injurious to the building?

In my judgment, they were. When I heard that an iron roof was about to be put on, I tried all that I was able to prevent it. I called on Mr. Arding, to request him to remonstrate with the proprietors. I also went to the timber-yard of Mr. Jones, in Rosemary-lane, and inquired the price of timber, and also whether he could give us room to frame a roof on his premises, for the late theatre. The proprietors were then, I believe, a week or more consulting whether they would have an iron roof or one of wood. I told the proprietors, and the architect, Mr. Whitwell, the prices for which a timber roofing could be obtained. I was present when the proprietors and Mr. Arding had a conversation about the time the putting up of a

wooden roof would take, and Mr. Arding remarked, he would require at least six weeks. The proprietors then gave no decisive opinion on the matter, but said they would consider of it. In a few days after, I believe three or four, they decided on having an iron roof.

Juror. What other obstructions, affecting the safety of the building, did you encounter from the proprietors?

Witness. I know of nothing, except not having truss-girders and trusses where they ought to have been.

Being refused this, did you mention to Mr. Carruthers or any other person the danger that might arise from such omissions?

I did not: for I was not aware of the precise nature of an iron roof; and it was impossible I could judge of its strength.

Did Mr. Carruthers give you any reason for not permitting you to put in these trusses, or truss-girders, which, in your opinion, were so necessary?

He said, there was not time, as they were determined to open the theatre on a certain day.

Was Mr. Maurice present at these conversations?

At most of them.

Did he concur with Mr. Carruthers in the refusal?

The countermand of the trusses I received from Mr. Maurice himself.

Now, in your opinion, was there any thing else material to the safety of the building refused you?

I don't know of any thing more than what I have mentioned, and they were the entire support of the building, to keep the weight from the roof.

What was your opinion of the consequences of such omissions?

Not knowing the strength of the iron roof, I asked the proprietors if I might hang weights to the roof. They told me that there was a friend of theirs from Bristol, and he would examine, and look over the roof, and see what could be hung to it. I heard the proprietors call him Mr. Evans; he is, I believe, one of the persons killed. He, Mr. Maurice, and myself, went over the roof. Mr. Evans said, that no perpendicular weight would hurt the roof. He would ascertain the fact when he went to Bristol, and a letter would be written. I used to see Mr. Maurice every day; and, on inquiring if he had heard from Bristol, he used to say, "Pooh, go on, there is no fear of the weight."

What was attached to the roof on the day of the opening of the theatre?

There were five girders before the proscenium posts, over the pit. They had four of them uprights; at each side of those uprights were iron columns. On the stage were four girders more, supported by rods of iron from the roof. On the prompt side there was an iron bar, clamped in different directions, where it hooked in, that supported the corner of the flies by the proscenium posts, when the uprights were taken away. There was nothing more than I have already stated, hung to the roof; one of the uprights on each side was taken away about a week before the opening, by my direction. I could not affix my grooves for shifting the scenery, unless they were removed. On the morning of the accident I saw the four uprights standing.

I ask you now, solemnly, on your oath, what was the cause of the accident?

It is impossible to form any correct opinion; but I should say that the vibration caused by the working of 40 or 50 men on Tuesday, in the carpenter's shop, attached to the roof, I think might have caused a jar, and was a great harm to the roof. That, in my judgment, was the principal cause; but if things had been attached which ought to have been, such a vibration would not have happened.

Then it is your opinion, if the trusses and cross-girders had been inserted, this accident would not have happened?

I am of opinion that it would not.

Cross-examined by Mr. Hill, for Mr. Whitwell.—It is always usual in good buildings to diminish the thickness of walls as they go up. There was nothing omitted in the quality or quantity of materials, or in the workmanship of the walls, which was proper for their strength or durability. After the third upright was taken away, the north end of the flies depended principally upon and from the roof. I remember that on the night the theatre opened, the eastern or "O. P." flies came down. They had been held up by a long iron rod, which was attached to a plank laid edgewise across the roof. That plank was not fastened, and there being about a hundred men in the flies, the plank pitched over on the flats. The rod fell about 4 feet, and rested on the grooves. I do not consider that accident to have been occasioned by the failure of the roof. On Tuesday (the day after the opening) there was a great weight carried up to the carpenter's shop—such as timbers, benches, &c., which the men had been working at during the day. I estimate that additional weight at about one ton.

The tackle to haul up that weight was affixed to the roof. I did not erect all the iron columns I had intended; two were omitted towards the gallery. I should think the length of girder left unsupported (except by the roof), by leaving out those two columns, was about 54 feet. Mr. Carruthers asked me to do without supports from the gallery. I answered him, that if I had a wooden roof I should know what to do, but I knew nothing of the power of an iron roof. Thirty-eight columns were eventually ordered, but I always understood that 40 were originally intended. I designed the stage department and carpenter's shop myself. I never received any instructions from Mr. Whitwell respecting the stage. He often spoke to me respecting the weight I was hanging to the roof. He never encouraged it, and strongly, often violently, expressed his opinion against it. He was violent to me in his disapprobation against it. I told Mr. Carruthers of it, and also the late Mr. Maurice. Mr. Carruthers asked me who employed me, and said, "Pray, Sir, who is your master?" I answered, "You are my employer." "Well, then," said he, "I am to give orders: I am your master, not Mr. Whitwell." Mr. Carruthers told me at another time that he had paid Mr. Whitwell all the money belonging to him, and that on his own behalf he was as good an architect as he, and could manage the men as well as I could. He desired me not to mention this, because he was sure to hear it again. I did, however, mention it to Mr. Pulsford. I never saw any thing to alarm me up to a few minutes previous to the accident happening. I was standing on the stage speaking to Mr. Maurice and Mr. Carruthers, when Mr. Blamire came up to me, and told me that I was wanted up stairs immediately. I in consequence left the stage, and was proceeding up stairs. When I got as far as the carpenter's shop, the roof fell in, and all was in ruins in less than a minute. I fortunately preserved my life by getting into the angle of the staircase near the south-west wall. No one that I recollect spoke to me on the safety of the building. Some of the workmen (carpenters) said they did not like the iron roof. There was nothing, that I saw, that would lead me to think that any thing was the matter.

March 11.

Mr. Shaw called, and farther examined: deposes that if time had been allowed him for the purpose, he could have supported the flies, the painter's and the carpenter's shops, without suspending them from the roof of the theatre in any way. Has been a carpenter about 33 years, and had much experience in large buildings. Mr. Carruthers, when witness remonstrated respecting the trusses, told me he was as good a carpenter as I was. An order given me by Mr. Carruthers, "implicated," in my opinion, the strength of the building. It was the countermanding of a wall, and substitution of a partition for it. That wall should have been carried up nine feet six inches higher than it was. I mean the wall intended to be built as a back for the boxes.

[Here Mr. Hill, on the part of Mr. Whitwell, admitted that he was cognizant and approved of the omission of that wall.]

Three uprights were put up on each side, but it was intended that two only on each side should be permanent; the third, although put up, was to be merely temporary. On the Monday preceding the accident, the plank of the O. P. fly fell down an inch or two: I did not communicate that circumstance to either of the proprietors, not thinking it of any importance. Mr. Whitwell was present at the time I told him of it, and he went up with me, examined it, and tried to ascertain the cause. I got up the fly with a tackle-fall that night, after the performances were over. I examined the re-sheathing of that fly on the Tuesday; it had not then given way more. I did not examine the O. P. fly on Wednesday morning. The P. S. or prompt fly, settled on Tuesday about half an inch. No other appearance of defectiveness was then apparent in the P. S. fly. I told Mr. Carruthers, on Wednesday morning, that I should be obliged to put two uprights at the end of each fly, on account of the weight attached to the roof. I accordingly sent Miles to Mr. Jones's timber-yard, to pick out a piece of timber that would cut into two uprights, seven inches square, and twenty-two feet long, and to have them cut as soon as possible. After that I suffered the flies to remain as they were until I could get the timber for my uprights. I did not substitute any thing in the mean while, for I had no dread or thought about the flies settling. On the following morning, namely, that on which the accident happened, the timber had arrived, and the uprights were in course of preparation when the theatre fell.

By Mr. Hill.—Knew Mr. Whitwell when a boy, and when he worked at the

bench. In witness's opinion, he knew the practical as well as the theoretical parts of his profession—that is the meaning of a bench architect.

Were not holes left in the building of the front wall, to admit the cantilivers of the balcony?

There were.

Were not even these small holes arched over?

They were, but the cantilivers were not put into them, in consequence of the balcony being brought lower down than originally intended. Some of the old holes were chased out to receive them. To my own knowledge, I never saw any proof made of the weight which the roof would carry.

March 12.

Mr. Pulsford being sworn, deposed as follows:—I am assistant surveyor to the East India Company; I was employed by the proprietors to measure the artificers' work at the Brunswick Theatre; two months before the accident, I repeatedly warned the late Mr. Maurice of the insecurity of the roof—made insecure, in my opinion, by suspending heavy weights from the iron ties of the roof. On one occasion, soon after the painter's shop was suspended, I gave my opinion to Mr. Maurice, that it would be advisable to have the opinions of persons of science and practical acquaintance with iron-work, and for that purpose I voluntarily promised that Mr. J. Bramah, of Pimlico, civil engineer, and Mr. Thomas Moorman, of Old-street, an eminent smith, should both attend at my request to give their professional opinion on the structure and security of the roof, I not having had much experience in iron roofs. The fact was—I doubted, and wished to have that doubt confirmed or removed by persons better acquainted with the subject than I was. The late Mr. Maurice told me he had received a letter from the patentee of the iron roof, or some friend of his, I cannot tell which, and that this letter assured him that there was no danger to be apprehended by the suspension of weights from the roof; he therefore declined my offer to obtain the opinions of the individuals whose names I have already mentioned. I still felt great apprehension that the structure would fail, from the suspension of those weights, and within three days of the theatre opening, I told Mr. Maurice that I felt quite nervous and uncomfortable whenever I went under the roof. Mr. Armstrong, the plasterer, and several other persons, were present when I spoke to Mr. Maurice on the subject. Mr. Carruthers was only present on one occasion, when I expressed my opinion of the insecurity of the roof. On this occasion, Mr. Shaw, the clerk of the works, told Mr. Carruthers that the timbers were not yet strutted, and when that was done, the vibration would cease. I have had conversations with Mr. Whitwell, the architect, in which I expressed my doubts as to the safety of hanging weights to the roof, and he agreed with me that it was very unsafe; but added, "That is a matter over which I have no control." I think the walls were fully sufficient to sustain the roof, and that the proximate cause of the accident was the suspension of the weight, to which I before alluded, to the roof, and there not being sufficient time to dry the walls. If the theatre had not been opened for two months, the accident might never have happened. In my opinion, the accident is not attributable, in the slightest degree, to any fault in the building of the walls. The walls were of a proper thickness, and the thickness was properly distributed. By the weight which was affixed to the roof, a lateral pressure was thrown on the walls. Walls are built to support vertical and not lateral, pressure. The weight of a proper timber roof for the building, exclusive of covering, would be from a ton and a half to two tons per square of 100 feet. The walls of the theatre were fully competent to bear such a weight, if applied vertically. In my opinion, there is no want of skill or care attributable to Mr. Whitwell: I consider Mr. Whitwell a skilful man; I have no reason to alter my opinion of him, and I should be happy to take his professional opinion at all times.

Are you not of opinion, that the architect was bound publicly to protest against any thing affecting the safety of the building?

I think it was his bounden duty to protest privately to the proprietors, but not publicly.

Mr. Shaw was again recalled, and in answer to questions put to him said, that in the openings where the windows were, the bond timbers were cut out, but that could not affect the safety of the building. That he was not aware of any tipping or dislodgment of the walls on the day of, or prior to, the accident. And that he does not know that the uprights would have prevented the accident; in Covent-Garden Theatre, which is such an immense pile of building, there is not an upright at all upon the stage.

Mr. Pullen, on the part of Mr. Carruthers and the representatives of the late Mr. Maurice, now produced two letters; one from Mr. Maurice to Mr. John Evans, of Bristol (a gentleman who lost his life by the late calamity), dated 20th January; and Mr. Evans's reply. The former stated that Mr. Barlow, the London agent of Messrs. Wellington and Co., of Bristol, who constructed the roof, having remonstrated against the suspension of weight from the roof, and disavowed all responsibility if the proprietors persisted in doing so, he (Mr. Maurice) wished Mr. E. to call on the manufacturers, and ascertain exactly what weight the roof would be able to bear. The reply of Mr. Evans stated that Mr. Tomlinson, a person connected with Messrs. Wellington's factory, had given it as his opinion that no fixed or stationary weight would effect or disturb the roof.

Mr. Whitwell, the architect of the building, was next examined.

[Being obliged, by the number of our impression, to go to press early each Thursday, we are sorry that we can only give a very general summary of the facts to which Mr. W. deposed. Altogether, his evidence appears to us to have been extremely satisfactory.]

Was at the theatre on the night of the opening, and had no apprehension of any accident happening like that which subsequently took place, without there being ample notice of the approach to such a failure. Had often expressed to the proprietors, his disapprobation of suspending weights to the roof, and assured them that imminent danger was likely to arise; but did not at the same time consider it as necessarily following, that the roof would come down, because such weights were suspended: there was a wide range between what the roof might possibly bear, and loading it to the breaking point. The material being wrought iron, such a roof could not, he thinks, have come down without giving sufficient indication of failure, in time to prevent the loss of life or limb. In his judgment, the cause which produced the calamity, was the loading of the tie braces of the roof with very heavy and unsteady weights. The iron roof put up, was much lighter than a wooden one would have been; it was judiciously constructed; and the contractors are, in the opinion of the witness, free from all blame. In the erection of the walls, no expedient or precaution which witness's judgment could suggest, was omitted, to enable them to support the weight they were to sustain. They were not at all injured by the insertion of the cantilivers (for the portico), which were pinned in by bricks and Roman cement. The weight suspended from the tie beams, had the same effect on them and the rafters, which a weight laid on the string of a bow would have on such string and the ends of the bow itself;—the tie beams were depressed, and the feet of the rafters pulled in till they were clear of the walls, and the whole roof then fell in.

(Adjourned to Friday, March 14.)

Plan and Section of the Building.

That our readers may the better understand the preceding evidence, we have given on the two following pages, a ground-plan and section of the building.

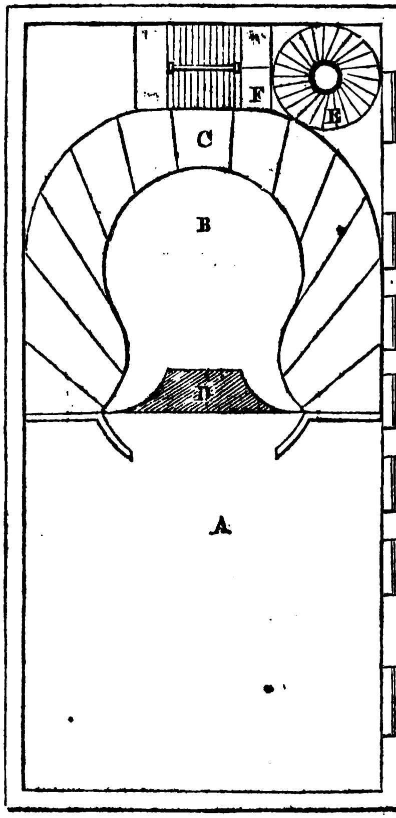
Ground-Plan.—A represents the stage; B the pit; C the boxes; D the orchestra; E circular staircase; F grand staircase.

Section.—A the proscenium; B B B the workshops suspended from the iron roof; C C C C dressing-rooms; D wall fronting Well-street; F the balcony, which projected 4 feet 6 inches.

Remarks.

The *flies*, so repeatedly alluded to in the course of the preceding evidence, are galleries running along each side of the stage from the proscenium to the back wall, where they are connected with each other by a smaller gallery. They are used for raising and lowering the grooves in which the scenery works, and for working the machinery generally. There are usually two tiers of them, and the upper tiers are connected with each other by slight bridges running across the stage, from which the carpenters adjust the borders, and other upper parts of the scenery, or remedy any defect in working the drops. These flies and bridges are in most theatres suspended from the roof; since it is almost impossible to join them on such a tracing on the wall as will render them sufficiently strong, or to support them from below, without an interruption to the movement of the scenery. All the pulleys, likewise, through which the ropes

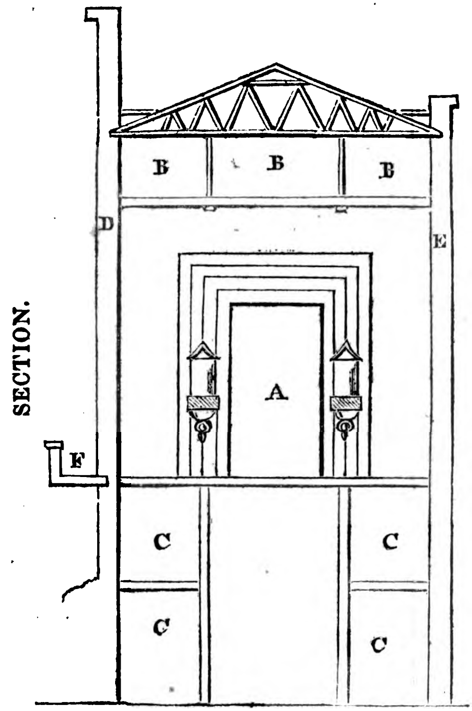
GROUND PLAN.



Side Front facing Wells Street.

pass to support the drops, borders, counterweights, &c., are likewise, in general, attached to the roof, and form, necessarily, a prodigious moving weight, perpetually acting upon it.

The provisions of the Builders' Act, the 15th of Geo. III., have been much discussed on this occasion, with a view to ascertain the powers vested in the local authorities relative to the manner in which public buildings should be constructed. It is remarkable that neither the word *theatre*, nor any place of public amusement, is mentioned in any part of the Act. The district surveyor, it appears, has no discretionary power relative to the thickness of the walls, in any description of building; his duty is imperative, according to the second, third, and fourth clauses of the Act. The first-rate houses contemplated by that statute are such as exceed nine squares superficial upon the plan, and offices that are thirty-one feet high to the top of the parapet. Party-walls are required to be two bricks and a half in the cellar story, two bricks from thence to the ceiling of the upper story, and one and a half to the top. All churches, chapels, brew-houses, sugar-houses, and distilleries, founderies, and buildings for the making of soap, melting of tallow, boiling of turpentine, making of glass or chemical works for sale, come under the first rate. A theatre exceeding nine squares superficial must be considered of the first rate or class. Now the Brunswick Theatre was a building of this description, 115 feet 3 inches by about



60 feet, and nearly 80 feet high. It had no party-walls, and the external walls, which were required by the Act to be two bricks from the foundation, and one and a half to the top, were three bricks from the foundation, and two and a half and two to the top; thus exceeding, by one brick all the way, the limitation of the statute. The majestic brick cone which Sir Christopher Wren erected between the painted hemispherical lower cupola, and the external leaden one, of St. Paul's Cathedral, to carry the lofty and heavy lantern of that edifice, was only half as thick.

A prejudice which is beginning to prevail against the use of iron for roofs, is likely to be greatly strengthened by the present accident. But as long as such a splendid proof of the ease and safety with which it can be constructed to bear every sort of tension exists, as the Menai Bridge, we shall not be easily persuaded that there is the slightest danger in its adoption. Architects would do well, however, to keep in mind the example which Mr. Telford has set them in the erection of that bridge; he ascertained before hand, by a numerous series of experiments, varied in every possible way, what such and such combinations of parts would perform: he did not erect the bridge first, and then try whether it could bear a thousand head of cattle or not; he proved that it would do so before he proceeded a single step. Of the perfect sufficiency of iron roofs, even for such large buildings as theatres, we have a sufficient proof, in the fact that an iron roof was applied to a theatre at Plymouth, in 1811, which has up to the present period answered all the purposes for which it was intended. This roof is composed of rolled iron; there is scarcely a bar in it thicker than the eighth of an inch, but there are eight or ten of these put together in the fashion of a coach-spring,

and thus amazing strength is obtained, and the failure of one bar is of little consequence. The architect was a Mr. Folkestone.

COIN FOUND AT ST. CATHARINE'S DOCK.

Sir,—Availing myself of the desire expressed by your Correspondent, J. Brown, to have some information respecting the coin found at St. Catharine's Dock, I beg your insertion of the following, hoping it will tend to throw some light upon the subject.

Your correspondent states, as his opinion, that the coin is probably one of Eric, King of Northumberland. But the general appearance of the coin being of a much more recent date, and it being certain that the generality of the coins of Eric have a rude-shaped sword on the reverse, and *none of them a head*, renders that supposition unlikely. Neither do we find the cross extending over the whole field of the coin, as it does in this, until Athelred II.; nor has any coin been met with (prior to the Conquest) having the quatrefoil border on the obverse and reverse, instead of the circle generally used, excepting the coins of Canute; to which monarch I have very little hesitation in ascribing the coin in question, from its very great similarity to his coins, and the probability there is of the inscription reading thus, CNVT REX ANGLO, which "J. B." might (from the great similarity there exists between many of the letters then in use) very easily misread. The inscription on the reverse adds more strength to my opinion—it being known that Canute employed a moneyer of the name of Leofwine, which name appears pretty plainly in the engraving; and providing I be right in reading the three last letters, AMT, they fix the mint at which this coin has been struck to be Southampton, which will add one more to the very numerous mints already known to have been used by Canute.

J. B.'s version of the legend, I think, must be altogether erroneous. The words *Le Roix seis*, or *zen*, I never met with on any English coin (the title always being either in the Latin or Saxon language); neither can I reconcile J. B.'s reading with the engraving.

I remain,
Yours, &c.
T. W. P.

Sunderland, Feb. 19, 1828.

Sir,—I am still at a loss to determine the appropriation of Mr. Brown's coin, if it be not one of Canute's. Since last addressing you on the subject, I have consulted such works as I was able—namely, Ruding, Simon, and Pinkerton; in the latter is figured the coin I had in my mind, when I said Mr. B.'s was similar in TYPE to one of *Cnut's*. It is struck at Dublin. Southampton is given as one of *Cnut's* places of mintage, written HAMT.

Mr. Brown, however, residing in the *great city*, is at the fountain head for obtaining information on the subject. I do not remember at present who has the care of the medallic department at the British Museum; but if the gentleman be as able and willing to impart information as his predecessor, I have no doubt Mr. B. may obtain it there. In which case, perhaps, he will oblige us with it, through the medium of your Magazine.

I am, Sir,
Your's, &c.
Δ.

SUGGESTED IMPROVEMENT IN THE NAUTILUS LAMP.

Sir,—In consequence of your notice of the nautilus lamp in a former Number, I got a friend to purchase one for me; but, to my disappointment, I found it would continue *useable* only two nights! for after having been used this small number of times, the upper part of the tube became encrusted with a hard carbonaceous substance, which adhered so strongly to the tube, that it could not be removed without breaking the tube, which being of glass, was of course thereby rendered useless; and had I not had some small glass tubes

by me, one of which I cemented into the bottom of the cup, I could not have used the lamp again without being at considerably greater expense than the whole article is worth.

Now I would suggest, that, instead of glass, these tubes should be made of *copper*. If made of this metal, I think the use of these simple, brilliant, and economical lights would be secured for a considerable time: for the tubes, in this case, would be easily cleaned by means of a pin thrust up them from the bottom.

One advantage attending these admirable night-lights is, that the unconsumed oil does not become heated, and thereby thickened and unfit for future combustion, which is the case when common floating lights are used; a material inconvenience, as, after a short time, the thickened oil, which sinks to the bottom of the vessel, must be thrown away, or the light cannot be trusted to continue burning all night.

These lamps should be so constructed, that, without any weight in the cup, they will afford the smallest possible quantity of flame; as a little water dropped into the cup will cause the flame to be increased to any required size.

I am,
Your old Subscriber,
Jan. 1828. B.

INDIAN BUILT SHIPS.

Sir,—I saw at Portsmouth, in 1815, an Indian built first-rate ship of war, with a round stern, and exceedingly full both fore and aft at the load water line; at and above which line, she very much resembled the build of what is called the Humber keels, although I conclude much cleaner built below that line. She was what may be termed all bearance. There was also another ship of the same description, likewise built in India, but not quite so full built as the former. If my recollection serve me right, the former ship was called the Asia, and the latter ship the Ganges. Those ships differed very materially in their model from that of any man of war which I ever saw, and accorded more with my ideas as to what a man of war ought to be than any model I have seen.

A very significant observation was made use of by one of the seamen who assisted to row the wherry in which I sat round the Asia (if I am right in the name), whilst joining me in expressions of admiration of her; namely, "that she had a larger bread-room, and could stow more bread, than any other ship in the navy;"—a proof of her fulness of build.

Having observed that the *Asia* has returned home from the Mediterranean, after having had her full share of the late battle, and having looked with some interest in various papers, hoping to see something stated in respect to her qualities, in which I have been disappointed, I take the liberty of requesting your insertion of this letter in your exceedingly useful "Mechanics' Magazine;" trusting, that out of the great number of your readers, some of them may be sufficiently conversant with her, and will have the kindness to state her various qualities, either positive or negative, by which they will greatly oblige,

Sir,
Yours respectfully,
An Admirer of Naval Architecture.

P. S. I have heard it stated, by good authority, that, during the first American war, an American merchant built two large ships, partly experimentally; one of which was built very clean and sharp, and the other very full—so much so, that a puncheon of rum could be stowed close against her stern-post; that, nevertheless, the latter was notorious for her quick sailing, and excelled all other ships then known in her qualities generally.

SIR W. CONGREVE'S NEW SHIP.

Sir,—Will Sir W. Congreve guarantee that the waves shall strike his "wave wheels" in *one* direction only, and that at *regular* intervals?

HENRY H——.

MISCELLANEOUS NOTICES.

Indian Remedy for Fever.—" The inflammatory fever called *labardillo* is common in the hot as well as in cold climates. The curative method adopted by the Indians may, in its prognostic, be considered an improvement on the cold affusion. Some clay is procured, and mixed with water until it acquire the consistency of batter, and the patient is smeared all over his body with it: after an hour or two an examination takes place, and if the clay has become parched, and is peeled off, death is considered to be the inevitable result; but if it be cracked, and the pieces adhere to the body, a favourable result is expected. This is most probably the fruit of observation, as I believe the science of medicine among such people generally is; but the effect of the application in the latter case is a copious perspiration, which is absorbed by the clay; by which an adhesion of the cutis takes place, and prevents it falling off; thus the experiment, if not at first founded on scientific principles, has been undoubtedly supported by practical facts."—*Stevenson's South America.*

Power of Vision.—A shepherd upon one of the mountains in Cumberland, was suddenly enveloped with a thick fog or mist, through which every object appeared so greatly increased in magnitude, that he no longer knew where he was. In that state of confusion he wandered in search of some known object, from which he might direct his future steps. Chance at last brought the lost shepherd within sight of what he supposed to be a very large mansion, which he did not remember ever to have seen before; but, on his entering this visionary castle, to inquire his way home, he found it inhabited by his own family. It was nothing more than his own cottage. Instances of the same kind of illusion, though not to the same degree, are not unfrequent in those mountainous regions. From these effects of vision, it is evident that the pupil and the picture of an object within the eye, increase at the same time.—*(From a Correspondent.)*

Transmission of Electricity.—M. Delarine, of Geneva, in a letter lately read at the sitting of the Academy of Sciences at Paris, announces his having discovered, that the degree of a body's conductibility of electricity greatly depends on the *quantity* of electricity which passes through it; so that, of the two conducting bodies, that which is the best conductor for a certain quantity of electricity, may be the less so for a stream either stronger or weaker.

Ultramarine.—M. Tunel, of Paris, has discovered a mode of manufacturing an artificial ultramarine, which is not only of a more beautiful quality and more brilliant colour, but 50 per cent. cheaper, than the natural ultramarine.

Remedy against Mildew.—The mildew, that fatal disease amongst us, which renders the straw blackish, and the grain lean and meagre, is almost unknown in the Netherlands. This partly arises from the wonderful care which the Flemish farmer takes in selecting the best corn for seed. Some farmers carefully pick out the best ears, whilst others strike an entire sheaf against a piece of wood, and take only the grains which first drop out. The seed is changed frequently—sometimes as often as every second year: it is likewise prepared in the following manner, which is said to afford an effectual remedy against the mildew: —Dissolve four ounces of copperas, or blue vitriol (sulphate of copper), in four gallons of water, for every three bushels of grain. Put the wheat into another vessel, and pour the liquid on it till it rises five or six inches above the corn: stir it thoroughly, and carefully remove all the light grains which swim on the surface. After it has remained half an hour in the solution, throw the wheat into a basket which will allow the water to escape. Immediately wash the grain in pure water, dry it, and it is ready to sow.

Sulphur a Preservative against Measles.—Flour of sulphur mixed with white sugar, administered in doses of half a spoonful, is stated in the "Massachusetts Spy," to have been found a complete preservative against the measles. In 1817, and again in 1822, when the measles prevailed to a great extent, many trials were made on children of different families and ages, and all who took it in time escaped the disease.

Natural Mathematician.—Madame Genlis relates, in one of the last volumes of her Memoirs, that a friend of hers, Madame de Lingré, possessed from her youth, the following astonishing, or rather miraculous, faculty.—" Without having studied in the least mathematics or geometry, she could, by means of an extraordinary gift of nature, resolve in a few minutes the most difficult and complicated problem, of whatever kind it might happen to be. Wishing me to be a witness of this phenomenon, she requested me to invite one of the most famous mathematicians of France (of my own choosing) to pass the evening with me, in order to propose to her problems of which she was at once to give a solution. I accordingly invited M. De Prony, who came to my house on the 20th of October: he brought with him three problems, which he had carefully composed for the visit; and the following is, without any exaggeration, a detail of what took place :—M. de Prony read the enunciation of the first problem; Madame de Lingré put her hand before her eyes, telling us we might converse as usual, and in two minutes she gave a perfect solution of the problem. The same thing occurred with the two others; and M. de Prony several times repeated, that such a gift was altogether inexplicable."

Enormous Spiders.—In the Brazils, the spider reaches an enormous size, with different habits from those of Europe. It stretches its web from tree to tree, and no longer appears a solitary insect; many hundreds live together, and form nets of such strength, that you may often see a bird of the size of a swallow, quite exhausted with struggling, and ready to fall a prey to its indefatigable enemy.

Galileo a Musician.—Among the arts and sciences which were indebted to the profound genius and labours of the celebrated Galileo, few could expect to find music holding a prominent place. It was this great astronomer, however, who first determined, with any considerable degree of accuracy, the proportion of the length, thickness, and tension, of the strings or chords of a musical instrument, with the flats and sharps, or with grave and acute sounds.

Expansive Force of Steam.—(From a Correspondent).—A circumstance lately occurred, rather of a singular nature, which strongly illustrates the powerful effects of steam. A strong stone bottle, half filled with water, and tightly corked, was placed by a servant girl in an oven, and forgotten. The water of course began to be converted into steam (by the heat of the oven), which burst the bottle, and was so expansive as to drive the oven door, which was of cast iron, from its hinges, against the kitchen wall, with such violence, that it was broken into several pieces. The oven itself, though of considerable weight, was carried from its seat, blew out both the kitchen windows, and tore down the fire-place. Several children were playing in the kitchen; but they fortunately escaped injury.

Sailing Sledges.—We remember, many years ago, two Englishmen fixing iron runners to a Russian sledge; with which, after rigging it with mast and sail, they started upon the Neva, and darted along at the rate of twenty-two miles an

hour. Having, in their progress, observed a wolf crossing on the ice, they steered directly towards it; and such was the velocity of the sledge, that it cut the animal in two. They had no doubt that, with a double quantity of canvas, they could have nearly doubled the velocity.—*Quarterly Review.*

Improved Chronometer Springs.—Mr. Isaiah Lukens has invented a mode of hardening the balance springs of chronometers, without impairing their polish, or injuring in the least their heliacal figure. He keeps the process a secret, but manufactures, we believe, for the trade.

American Hemp.—The following is an extract from the recent report of a committee appointed to examine the comparative durability and strength of hemp grown in the United States, with that imported from Russia:—"Experiments were made with samples of each kind of hemp before they were spun into yarns; and in that state the American hemp was found to be the strongest; and after being made up into cordage, and tested on board of a ship under the command of one of the commissioners, its strength and durability was ascertained to be fully equal to cordage made of the best Russian hemp; or, if their be a difference, it is in favour of the American. Admitting their staples to be equally good in their original state, the Russian hemp is liable to sustain more or less injury in transportation. The average weight sustained by 12 yarns, taken indiscriminately from a piece of Russian and a piece of American cordage of similar size, was, respectively, 140 and 123 pounds; incontestibly proving that American hemp, when newly made cordage, is superior in strength to that of Russia."

Natural Stores of Gas.—The village of Fredonia, on the shores of Lake Erie, is lighted every night by inflammable gas collected from certain burning springs, as they are called, in its vicinity. A similar use is made of a natural store of gas, in the salt mine of Gottesgabe, at Rheine, in the county of Peklenbourg. For sixty years past, there has issued from one of the pits, which has on this account been called "The Pit of the Winds," a continued current of inflammable gas. The same gas is produced in other parts of the mines. M. Reoders, the inspector of the salt mines, has used this gas for two years, not only as a light, but as fuel for all the purposes of cooking. He collects it in pits that are no longer worked, and conveys it in tubes to the house. It burns with a white and brilliant flame. Its density is about 0.66. It contains only traces of carbonic acid, and sulphuretted hydrogen, and olefiant gas.

French Soups and Sauces.—A French cook is indebted for his delicious sauces entirely to the produce of the kitchen garden. Ginger, cayenne pepper, and the host of hot exotics, which in England render the palate a fiery furnace, are wholly excluded from French cookery. Wine, oil, butter, and *bouillon* (stock), form the bases of all soups and gravies; which are flavoured with herbs from the garden. French cookery may therefore be pronounced extremely healthy, instead of the reverse, as is supposed in England. —*Literary Gazette.*

Nitric Acid in Rain Water.—After repeated analysis of a great number of specimens of rain water, M. Leibig (*Ann. de Chimie*) found that in every instance in which rain water was collected during a thunder storm, the water contained a sensible quantity of nitric acid, combined either with ammonia or with lime; while rain water collected on ordinary occasions scarcely manifested the slightest trace of nitric acid. It is the opinion of M. Leibig, that the electric fluid, in traversing the upper portions of the atmosphere, is the immediate agent through which nitric acid is formed, by enabling the nitrogen of the atmosphere to combine with an additional portion of oxygen; and, subsequently uniting with aqueous vapour, the latter descends to the earth in the form of rain.

The Gulf of Lyons—is generally supposed to be so named after the city of Lyons, which is at a considerable distance. Its proper name is *Golfe de Lion* (*Mare Leonis*, or Lion's Gulf); and it has been so styled from the almost perpetual roar occasioned by the precipitation of the Rhone into this part of the Mediterranean, and the numerous shipwrecks of which it is the scene.

Colour of Soils.—An experiment which I have often repeated upon light as well as tenacious soils with like success, demonstrates how greatly the colour of a soil influences the accumulation of heat. Coal-ashes were sprinkled over half the surfaces of beds sown with peas, beans, &c. and on these the plants invariably appeared above ground two or three days earlier, obviously on account of the increased warmth; it being a well-known fact, that dark-coloured bodies absorb caloric more readily, and in larger proportions, than those of a lighter hue.—*Correspondent of the "Gardener's Magazine."*

Restorative from Drunkenness.—M. Masurer, a French chemist, has discovered that the acetate of ammonia is an effectual restorative from a state of intoxication. From 20 to 30 drops in a glass of water or capillaire, will, in most cases, relieve the patient from the sense of giddiness and oppression of the brain; or, if that quantity should be insufficient, half the same quantity may be again given in eight or ten minutes after. In some cases the remedy will occasion nausea, or vomiting, which, however, will be salutary to the patient, as the state of the brain is much aggravated by the load on the stomach, and the subsequent indigestion.

NOTICES TO CORRESPONDENTS.

Although we have this week printed an extra sheet, several papers are still standing over for want of room, to which we wished to give an earlier place than they are likely to obtain—the communications, in particular, of Mr. B. and Mr. H. on the pressing subject of Fire Escapes; of Mr. Saul, on Hot-house Frames and Field-Gates; Mr. Mackinnon, on Falling Bodies; Mr. Utting, on Numbers, &c.; and Mr. Jongh, on the Patent Laws (which we beg to say are not on our own part forgotten).

In consequence of numerous representations which have been made to us, that it would be a great convenience to Subscribers to be able to transmit our weekly sheet through the medium of the post, it is our intention to commence the publication of a Stamped Edition in the first week of the ensuing month. As no more copies of that edition will be printed than are ordered, persons desirous of obtaining it, are requested to make us acquainted with their wishes, through the medium of their customary agents, as soon as possible.

Communications from Vectis—T. M. B.—Mr. Dolley—Mr. Saul—F—A. M. C.—Mr. Baddeley—J. R.—P. A. P.—Natron, received.

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Mechanics' Magazine,
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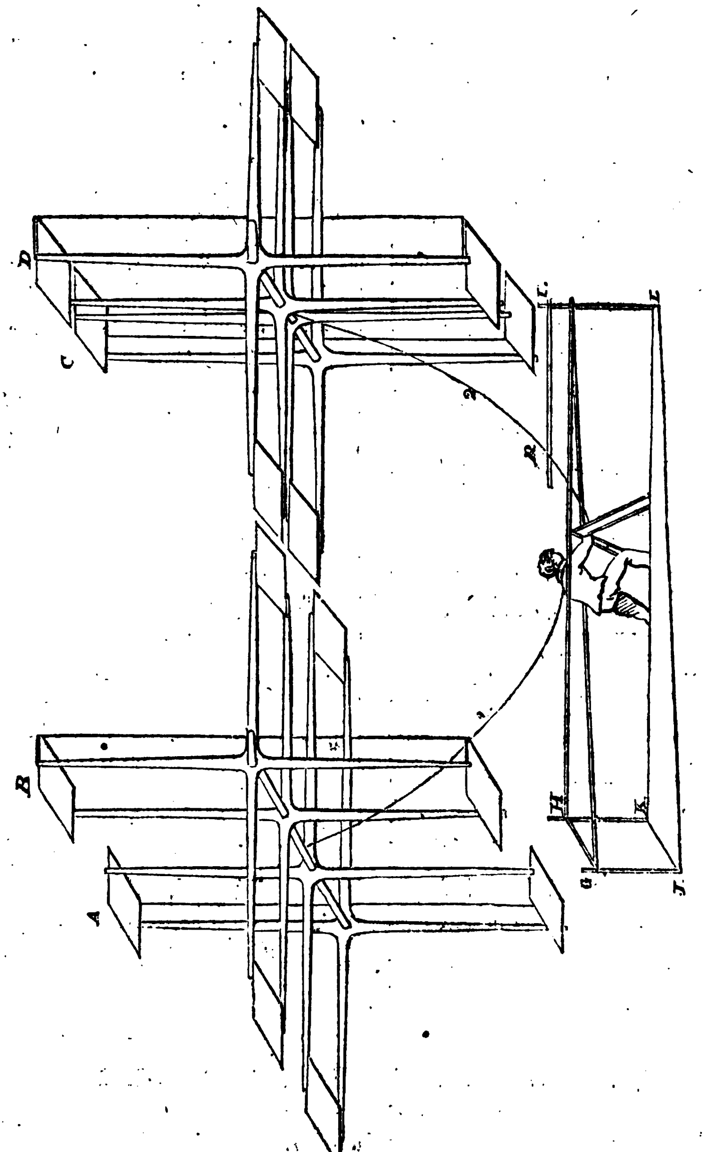
AERIAL CARRIAGE.



AERIAL CARRIAGE.

An Inquiry into the Possibility of Man raising himself into the Air by the Application of his own Power.

In endeavouring to imitate the actions of animated nature by mechanical means, we are naturally induced, in the first instance, to make those movements the guide of our proceedings as much as possible. In accomplishing this, however, we find great obstacles, 1st, From the difficulty of analyzing the actions themselves, which are the objects of our imitations; 2dly, From the complicated connexion that exists between the will and all animal power; which it is impossible ever to obtain in pure mechanical operations: thus, in flying, when we examine and compare the structures of the wings of birds with those of the insect tribe, although, in the first, there can be no doubt as to the reciprocating motion of the wing; still, in the latter case, it is very doubtful what description of vibration takes place—since it appears that the fine filmy substance which forms the interior of the membrane of the wing of the beetle, and other such cumbrous insects, is scarcely capable of a similar action to that given by the wing of a bird; at the same time, that the velocity given by this action is so great, that it is impossible to form any opinion of it by observation. The velocity of the flight of these heavy insects, compared with the very small area of their wings, forms one of the most curious parts of this great problem of nature. The buz created in the operation resembles much more the noise produced by a rapid rotary motion than that of a reciprocating one; and, indeed, it may be almost pronounced impossible to be produced by the latter alone. Hence, therefore, it seems probable, that this motion is a combination between a rotary and a reciprocating action—that is to say, that a very considerable degree of angular motion, perhaps as much as 90 degrees, takes place at every stroke of the wing, producing a sort of sculling movement, by which the air is allowed to escape in the returning stroke, not otherwise provided for in these wings, though in those of the bird it escapes through the feathers, which act as valves.

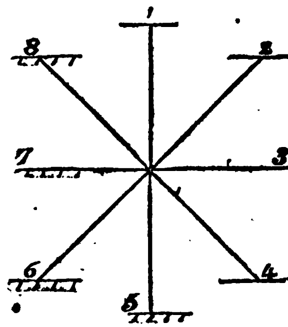
From these reflections on the subject of the beetle's wings, it seems fair to conclude that nature has not lost sight of the rotary motion in this great problem. From the difference of bulk, in the body of the beetle and the bird, as compared with the sizes of their respective wings, it is evident that a great effect is produced by this partial rotation of the wing of the former. In attempting, therefore, to solve this problem by artificial means, we must not neglect the example before us; and I am convinced we shall find, in conformity with that example, that smaller surfaces, thus applied to the bodies of men, will produce greater effect *by a rotary motion* than in any other way.

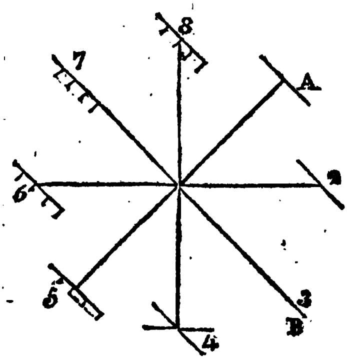
No attempt has hitherto, I believe, been made to raise the body into the air by surfaces impinging by this description of movement; and the difficulty of giving sufficient velocity to large surfaces by means of a reciprocating action has, probably, been the cause of the constant failures that have hitherto taken place. Now, in producing the required impulse upon the air by rotation, art will be found to have greatly the advantage over nature. Since the approximation to this motion in the fly's or beetle's wings, is very limited; while, as regards the production of a reciprocating motion in the wing of the bird, nature has decidedly the advantage over art.

Under these considerations, therefore, I shall proceed to develope a plan for raising the human body in the air, by a rotative motion, which, for the reasons above given, I think will be more likely to produce a successful result than any thing yet attempted, and which, indeed, in the course of this paper, I hope to prove actually capable of producing the effect intended. The following is the arrangement proposed:—A B C are four rotary propellers, or wings, in the form of paddle-wheels, furnished each with eight vanes of silk, strained on brass tubes, or other fit materials, forming the frames thereof. These wheels are mounted on three uprights G H I, connected with a triangular platform J K L, on which the person intending to travel is placed; and from which he will give the necessary rotary motion to the wheels, and direction to the carriage, by means which will presently be more particularly explained. In the mean time, the machine may be conceived to be a sort of aërial phaëton, having the silken vanes, which are to produce the effect of wings, placed above the body, of due magnitude and capable of sufficient velocity. Previously, however, to calculating what this sufficient velocity, and what these dimensions, should be, it will be necessary to say something more as to the construction and operation of the wheels themselves. It is obvious, that if the vanes were fixed, as those of a

common water-wheel, the whirling them round would produce no effect whatever to raise or propel the machine. They must, therefore, be so constructed that their planes may be always parallel to each other as they revolve; and the plane of their common parallelism adjustable at pleasure. A very simple mode of effecting this will hereafter be explained. By this parallelism of the vanes, their surfaces are, in addition to the above arrangement, so constructed as to allow the air to pass through in one direction by flaps, while it is prevented from passing by the closing of these flaps on the other: it is evident that when these four wheels are made to revolve, there will always be a certain quantity of impulse, or stroke upon the air, given by them in any one direction, agreeably to the arrangement of the plane of parallelism. Thus, if the vanes are so set, that in revolving they shall be parallel to the horizon, then will the whole of their impulse, or stroke upon the air, be perpendicular to the horizon, and their whole tendency be to raise the machine perpendicularly; while, if the plane of parallelism be so adjusted as to make an angle of 45 degrees with the horizon, then their joint tendency will be to advance the machine one foot horizontally, for every foot it rises perpendicularly; and thus, therefore, it is evident that the angle of flight may be regulated either from the perpendicular direction to the horizontal, or to any angle above or below; and that a continued impulse may be obtained by means of a rotary motion, in any given direction, and to any extent of force, according to the position, magnitude, and velocity, of these vanes.

It should be remarked, that, in calculating the effect produced by these propellers, only half the number of vanes, whatever that number may be, will act at the same instant;—one half only of them striking downwards, so as to produce a positive ascensional force; while the other half moving upwards, their flaps are opened so as to allow the air to escape, and their effect is, therefore, merely negative. The acting surface of such a propeller, containing 80 square feet, would, in fact, be only 40. Thus, in figures 2 and 3: in fig. 2 the vanes, Nos. 1, 2, 3, 4, are efficient in producing an ascensional motion; while Nos. 5, 6, 7, and 8, are negative, by the opening of their flaps. In fig. 3, the vanes being set to act constantly at 45 degrees with the horizon as the wheel turns from A to B, Nos. 1, 2, 3, and 4, will be the only effective vanes, advancing the machine one foot horizontally, while it ascends

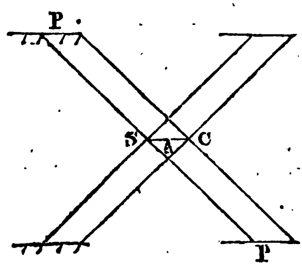




through the same space; the vanes 5, 6, 7, and 8, will, as before, open their flaps and become negative.

The mode of constructing these propellers, so that they may be made to revolve with their vanes parallel, and that their parallelism may be varied at pleasure, is simply as follows:—The wheel P, P, fig. 4, must be made to revolve by a socket on a fixed spindle S. The vanes also, whatever be their number, must be made to revolve freely at the end of the radii P P. At the end of the spindle S, must be placed an arm A, which may be made to revolve upon the spindle, so as to be fixed at any desired angle. A point C, on the arm, must be assumed as a second centre, from which revolving rods of communication must be carried to one of the corners, C C C C, of the different vanes; and with this construction it will be evident, that if the

second centre C be fixed in a perpendicular line above the end of the spindle S, the vanes will always move round parallel to each other in all situations, and in



all situations perpendicular to the horizon; while if the centre C be placed horizontal with respect to the spindle S, the vanes will revolve, in all situations, parallel to the horizon; and again, if the arm A be set at 45 degrees, then the vanes will revolve, in all situations, at an angle of 45 degrees.

I shall now, therefore, proceed, as the next step, to calculate what their magnitudes and velocities should be. It has been ascertained that a current of air moving at the rate of 100 feet per second, and impinging on a surface of one square foot, would hold about 15 lbs. *in equilibrio*. In other words, a surface of 1 foot square, impinging with a velocity of 100 feet per second, would sustain, in like manner, a weight of 15 lbs. in the air; so that if we suppose a man, with the apparatus above described, to weigh about 300 lbs., it would require 20 square feet, moving at the rate of 100 feet per second, to sustain it. Should it, however, be considered that this velocity is too great to give to a machine constructed of materials such as those above described, the velocity may be reduced by increasing the surface as the squares; and it will accordingly be found that 80 square feet would be sufficient for the area of the propellers, supposing them to revolve at the rate of 50 feet per second; in which case they might consist of four vanes, each five feet long by two feet wide; which is evidently not an inconvenient surface to put in motion. It may, however, perhaps, be still considered that 50 feet is too great a velocity to attempt; if therefore these propellers be made with eight vanes similar to those above mentioned, instead of four, it will be found that a velocity of 36 feet per second will be sufficient to raise 300 lbs. in the air; and it is considered that there is nothing inconvenient either in the dimensions of the propellers themselves, or in the velocity of their motion; and if the diameters of these rotative propellers be twelve feet, their vanes will not only be at a sufficient distance to act with full effect, but one revolution of each, per second, will give the required velocity of 36 feet.

The only remaining consideration is, whether a man's power is sufficient to give this velocity to these propellers; and of this, I conceive, no doubt can exist. The measure of effort required to produce this velocity, may be estimated as the weight actually sustained by it in the air. Now it is known that the power of a man will raise 600 lbs. weight through ten feet in a minute—that is to say, 300 lbs. through four inches in a second—with the same effort on the part of the man which is commonly assigned to him as the measure of his bodily force; that is to say, the raising of 600 lbs. through 10 feet in a minute. This velocity is certainly not very considerable; nevertheless, such a machine would have an ascensional power of twenty feet in a minute—allowance being made here, as throughout the foregoing, for friction, and the yielding nature of the medium in which it acts.

By fig. 1 it will be seen that the person working this machine is supposed to give the necessary rotary motion to the propellers, by a winch upon the stage on which he stands. On the stage also, he will have the power of steering the machine by means of a tiller R, turning the upright I, which carries the two fore wheels C D; thus giving any requisite obliquity between the two fore propellers and the two hind ones. At the same time also, by ropes 1, 2, fig. 1, he will possess the power of shifting the arm A, described on fig. 4, so as to render them either purely ascensional, or partly ascensional and partly progressive.

It appears, therefore, that we are warranted in concluding that this great and long sought-for desideratum is attainable, but that means entirely different from those hitherto resorted to must be put in force; that is to say, a continued and very rapid action upon the air, which can only be obtained *by a rotary motion*, certainly not by a reciprocating one—the only method hitherto attempted. It may also be observed, that the powers of such a machine might be very greatly increased in proportion to the bodily force employed, by making it capable of being

worked by more than one person; since the weight of such a machine, capable of carrying ten men into the air, need not by any means be ten times as great as that required for carrying only one hence; therefore, by multiplying the numbers, an excess of force might be attained to increase the rapidity of flight to a very great extent: upon which principle, also, it is perhaps not going too far to suppose that elementary power may ultimately be introduced for working such an engine.

With respect to the dangers of travelling in an aërial machine, they are not much greater than those of travelling by land—certainly not so great as those of travelling by water; since the altitude to which the machine would be required to be raised, would not necessarily be greater than that of an outside passenger by a stage coach. The great security of this machine would be, that however great the storm in which it moves, and however great the velocity, it would be subject to none of those dangers which in ordinary navigation arise from the contending elements of wind and water. An aërial carriage, capable of supporting itself in the air 15 or 20 feet above the surface of the ground, might travel at the rate of above sixty miles an hour, with all the ease and steadiness with which it would glide through the air. It would have nothing to dread from its height above our surface, nor from the badness of roads. Neither forest, nor river, nor mountains, would oppose the progress of the navigator in the air: like the water-fowl, he would skim in the tempest over the billows of the ocean, reckless of their fury. He would pass, unconscious as it were of motion, with the velocity of the wind. This, it is true, applies only to the supposition of travelling with the wind; but as the machine is capable of great powers of positive motion, it may be made to travel against a strong wind, and must therefore be constructed of sufficient strength to resist the force of that element. It is not, however, from the action of the wind that the ship suffers in ordinary navigation, but from the combined action of wind and water; and from this the traveller in the air has nothing to dread.

We must not, however, conclude this paper, without saying a few words on the subject of the powers of flight, which our machine possesses, against the wind. It has already been stated, that if the materials were such that the velocity of these propellers might be doubled, their powers of flight would be quadrupled, and the same machine would carry into the air four men instead of one, by doubling the diameters of the rigger on the first motion. As, therefore, the power of each man employed is estimated as raising 300 lbs. weight, the power of four men would be equal to the raising of 1200 lbs. The weight of the machine is not supposed to be increased in this latter case,—it remaining, as before, 150 lbs. The power requisite merely to raise the machine and four men will be 750 lbs.; when four men, therefore, are employed at their full force, the machine will possess an excess of power beyond the mere carriage of itself and crew, of 450 lbs. If, therefore, such a machine be supplied with an additional propeller, the whole efforts of which shall be devoted to the employment of this power in the production of a horizontal motion in the machine, it will be found, supposing the area of resistance of the machine against the air to be 50 feet, that the horizontal motion will be equal to 73 feet per second; for the maximum velocity, attainable by this power, will be that which results from the computation of the resisting area of 50 square feet, and the power of 450 lbs. upon the datum abovementioned, of 1 foot square, operating with 15 lbs., having a velocity of 100 feet per second. Now the velocity of 73 feet per second, is equal to that of 50 miles an hour:—the strongest gale that blows is computed not to exceed 60 miles an hour; consequently such a machine would considerably more than stem the gale in any ordinary breeze—in calm weather, it would proceed at a rate which would perform a journey to India in five days. If one of these machines were to be constructed to go by steam—say by a three-horse power, reckoning eight men to one horse; then such an engine, by the foregoing calculation, driving 24 propellers, of 12 feet in diameter, at the rate above calculated of 73 feet per second, would have an ascensional power of 8400 lbs. The weight of such an engine, on Trevithick's principle, with a small boiler, might be reckoned at 2000 lbs. The weight of the fuel for one week for such an engine may be reckoned at 1500 lbs.; the weight of water required for such an engine on Perkins's principle, about one hogshead, that is 500 lbs.; weight of framing and wings, 2400 lbs; crew of four men, 600 lbs.: which allows 1400 lbs. spare power to be devoted entirely to progressive motion, or for the carrying any

additional weight within that limit. If the whole of this power be applied to the progressive motion, then, supposing the surface of the machine exposed to the resistance of the air to be 150 square feet, the progressive velocity of the machine given by this excess of power, beyond the power necessary to sustain the above weight in the air, will be 125 feet per second. This velocity is, however, far beyond any thing which we ought to contemplate; allowing, therefore, 50 feet per second as the maximum, this machine, with the three-horse power engine, would carry nine or ten men, or any equivalent burthen, 1200 miles a day.

W. C.

INQUIRY INTO THE FALL OF THE BRUNSWICK THEATRE.

ADJOURNED INQUEST.

(Continued from page 122.)

March 14.

Major Goff sworn and examined.—Is surveyor of the district. At the commencement of the building of the late Brunswick Theatre, attended every day, to see that the regulations of the Building Act were carried into effect. Found the walls in every part much thicker than was required by those regulations.

The Coroner. Let me call your attention, Mr. Goff, to the 49th section of the Act, which prohibits the erection of bay-windows, or any other projection, next to the public street. Was there any such erection constructed in front of the late theatre?

There was a balcony, which extended beyond the line indicated in the Act of Parliament; but I considered that that was sanctioned by the provisions of a subsequent Act (called "Michael Angelo Taylor's Act"), which empowers the Commissioners of Pavements to give leave to erect such erections. The deceased Mr. Maurice had applied to the Commissioners, and obtained their permission.

In your judgment and opinion, what was the cause of that accident?

I consider that it was occasioned by the immense weights hung to the roof.

A Juror. Did you state to any person your apprehension of danger from that circumstance?

No; I was never called upon to give any opinion on the subject: I never observed any thing dangerous.

Mr. James Wellington examined.—The iron roof of the late Brunswick Theatre was manufactured under witness's direction, at Bristol. Did not prove it, knowing it of much greater strength than was required. The bars of which it was constructed were one inch thicker than those generally wrought for such purposes. It was by no means calculated by witness that any weights should be suspended from the tie-beams. Is of opinion that it was perfectly adequate to its proper use. Has in his hand certificates from various companies for whom he has erected iron roofs, none of which have given way. The roof of the Brunswick Theatre rested on a cast-iron wall-plate placed over the wooden one. It was in four pieces of four feet in length, which were dovetailed one to another, so that they formed one continuous plate. It was not fastened to the wooden one, but was imbedded in a layer of mortar. There was no attachment by bolts, pins, nails, or screws. The tie-beams had no connexion with the walls of the building; they did not rest on them, but are attached to and connect the rafters. Provided for the extra span by giving an additional strength of iron; and did this, acting on the sound architectural maxim of, "Let it be stronger than strong enough." There is no person of the name of Tomlinson connected with witness in trade; neither did witness, nor any person with his approbation and his knowledge, ever consent to, or sanction, directly or indirectly, any of the proprietors in hanging any weights from the roof. The quality of the iron made use of was of the best Welsh, and of that kind which is most approved of for iron roofing. The weight of a timber roof, to cover a building of similar extent, would, to the best of his belief, have been more than double that of one constructed of iron. The absolute weight pressing upon the walls was calculated at from 39 to 40 tons; but such an additional weight as witness has heard described as being annexed to the roof, must inevitably have brought it down: has no hesitation in asserting this. The Mr. Tomlinson before alluded to was the original patentee of wrought-iron roofs. Cannot see how Mr. Tomlinson, not being interested, could presume to give any opinion on the construction or capabilities of the roof of the late Brunswick Theatre. Had he examined it, however, is sure that if he had been told what weights were to have been suspended from its tie-beams, he

would have considered it most dangerous and improper.

Mr. John Barlow was next called, who deposed as follows:—I am an iron merchant, residing on Dowgate-wharf. In August last, Mr. Whitwell applied to me on the part of the proprietors of the intended theatre in Well-street, and as agent to Mr. Wellington, for an iron roof for that building. I told him that we had then a fine one in a state of erection at Deptford-creek, for the Gas Company, which was 52 feet in span by above 190 feet in length, and which carried a heavy cupola or lantern. I took them to Deptford to view it; and so satisfied were they with its examination, that I received instructions to order Mr. Wellington to proceed with the roof, according to the directions which they had forwarded to Bristol. The roof was sent up, when constructed, with Mr. Wellington's foreman, and three of his men, to superintend its laying on. Some time towards the latter end of January, when the roof had been standing and finished nearly three months, it was reported to me that there were some slight leaks in the gutters, which I ordered to be repaired. The men who made these repairs informed me that heavy weights were suspended from the roof, and I in consequence immediately wrote a letter to Messrs. Maurice and Carruthers, disavowing on the part of Mr. Wellington all responsibility as to consequences that might accrue.

The letter was here read, and it was in the following terms:—

Dowgate Iron Wharf,
Jan. 25, 1828.

Dear Sir,—The workmen, who have been repairing the gutters at the theatre, report to me that you are hanging very heavy works to the iron roof. Now, as this was never contemplated in its construction, I feel it my duty, on behalf of Mr. Wellington, to disavow all responsibility as to the result of such a measure. I do not say that the roof will not bear it; but as it was not contemplated in the construction, or contract, it is but right that I set Mr. Wellington free from all contingency by this protest, &c.

I am yours faithfully,
JOHN BARLOW.

Messrs. Maurice and Carruthers.

Having been afterwards applied to, to say what weight the roof would bear, witness sent the following answer:—

Dowgate Iron Wharf,
Feb. 23, 1828.

Gentlemen,—Not being myself a professional man, I could not give you any directions as to the roof, if I surveyed it; and having, by the order of my principal, protested against any weight whatever being suspended to it, I cannot, with propriety, interfere farther; but beg to remind you that nothing in Mr. Wellington's contract can hold him responsible, should any catastrophe take place.

I am, &c.
JOHN BARLOW.

Messrs. Maurice and Carruthers.

"Mr. Whitwell subsequently told me that he considered the weights as extremely dangerous. In my opinion, the powers of expansion and contraction, to which, from the various degrees of temperature, the roof might have been exposed, cannot satisfactorily account for this accident. It is impossible that the variation of temperature, to which it had been subject, could have been so great as that of those which are over gas-houses: there the heat is more excessive, and the change from that to cold more rapid, and I have frequently seen the tie-beams in such buildings enveloped for some time in flames without any injury occurring.

March 17.

Michael J. Sherlock, slater, deposed as follows:—Contracted to slate the roof of the late theatre. Has been a slater for eighteen years, and all his ancestors have been slaters. Has had experience, and thinks he possesses some knowledge as to iron roofs. The roof now in question was the strongest he ever slated. About the 25th of January last, was employed in superintending the men sent by Mr. Barlow to repair the gutters, (see Mr. B.'s evidence;) when, seeing the preparations which were then making for hanging the flies, &c. from the roof, he was struck with the danger to be apprehended from such a proceeding, and immediately afterwards spoke to Mr. Barlow on the subject. Thinks the weights suspended to the roof were equal to about 100 tons, and is of opinion that they were the cause of the destruction of the theatre.

George Richardson, gas-fitter (a former witness), re-examined.—The front wall of the roof fell (almost) simultaneously. First, a few slates were heard falling against the iron bars of the roof; then they increased rapidly in quantity,

and at last came the whole roof like a clap of thunder. An undefined dread that "something would happen" had prevailed for some time amongst the workmen, who did not like what was going on.

James Silvester, smith.—Was employed to put up the hot air stoves at the late theatre. On the day before the accident, Atkins, a bricklayer, pointed out to the witness that three of the struts were very much drawn out of their proper positions. Was at the theatre on the morning of the catastrophe, and was going up, by the earnest request of Spence, the foreman of Mr. Pound, to look at the roof, when, at the top of the winding stairs, they met Atkins, in a state of great agitation, who called out, "For God's sake, come along; there is a great alarm in the roof; it will be all down together:" ran down very quickly over the stage, out at the stage entrance, and up towards the north end of the building. On looking back, saw, after a few minutes, three windows breaking over the stage entrance; next heard a fall of something heavy, and instantly after two distinct claps; the front pilasters then seemed to swell out; the south end of the theatre broke; the north end followed; and the whole building came down together.

Mr. W. Lewis Wyatt, one of his Majesty's surveyors of the Board of Works.—Had surveyed the walls of the late theatre, along with Messrs. Boucher, Bulmer, and Todd, and has come to the conclusion that the building work was well done; but will not take upon himself to say that the walls were calculated for a building of this description. Can give no opinion as to the general architectural design; can only say the walls were well and substantially built. The mortar was mixed in fair proportions of lime and sand; it had adhered to such of the bricks as were new, but not so closely to the old ones mixed with them, in consequence of their being less porous.

Edward Atkins, the bricklayer, alluded to in Mr. Silvester's evidence.—Was on the roof on the morning of the accident, and then perceived that the upright bars of the roof which were connected with the tie beams were bent, and were removed three inches from their proper position. Saw also that a slate had left its place, and that the brackets of the carpenter's shop had torn away about six inches, leaving a part of them on the partitions, and some on the ties. Heard a carpenter call out to him, "It is not safe to stop here!" leaped off the scaffold, ran down the winding staircase, and escaped about a minute before the building fell in.

Adjourned to the 28th inst.

(To be continued in our next.)

MR. SHIRES'S NEW ASTRONOMICAL INSTRUMENT.

Sir,—As I am a dabbler in optics and astronomy, I should be glad to know what is the *use* of Mr. Shires's new instrument, figured on page 368 of your 8th volume.

JOHN BRITSCHMEISTER.

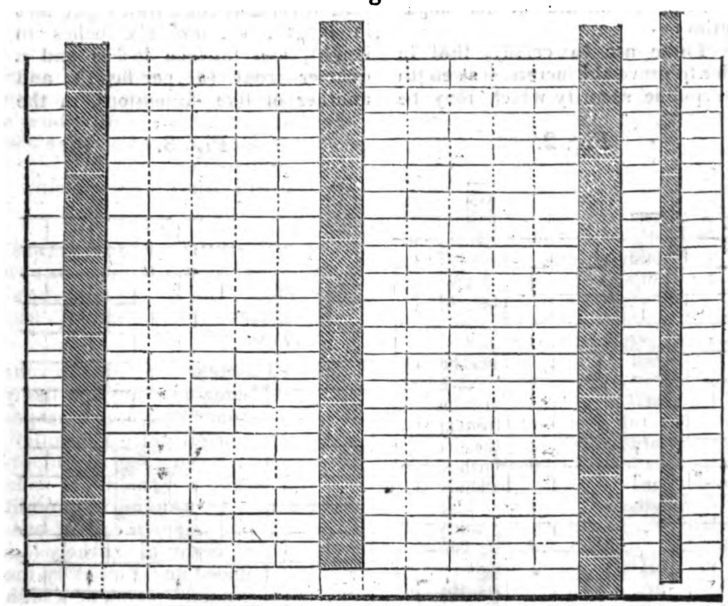
PLAN OF BONDING BRICK WALLS, BY WHICH SUCH ACCIDENTS AS THE FALL OF THE BRUNSWICK THEATRE MIGHT BE PREVENTED.

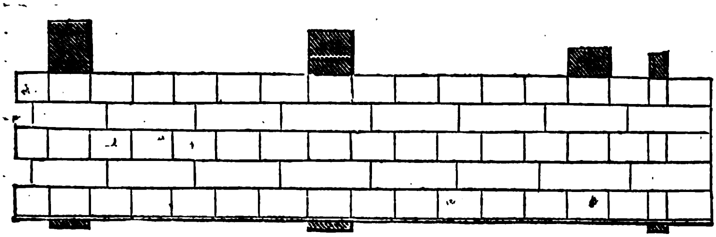
Sir,—The ready insertion in your valuable Magazine of any hint likely to produce improvement, encourages me to place before you an invention, which, had it been generally adopted, and patronized (as much as in its first trial it was admired), might have been the happy means of preventing the recent melancholy loss of life! produced and caused by the weakness and inadequacy of a high piece of brickwork, to support the weight placed upon it; I allude to the bulging of the wall of the late new Brunswick Theatre: for I feel no hesitation in asserting, that if it had been constructed on the following plan, it would have sustained *more weight than it did without danger*. I write without much practical knowledge, and am little versed in the methods necessary to bring such an invention forward; I therefore place drawings of the plan, and copy of a certificate, before you for public inspection. The inventor and joint patentee is deceased; I am in possession of the patent, and all the models formed by the hand of the inventor, and shall act according to the intimations given through the medium of your valuable Miscellany.

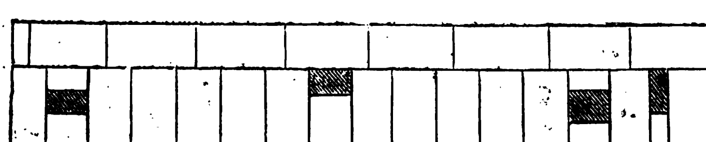
A Constant Reader,
G. M ——.

Figures 1, 2, and 3, which have been made from the drawings accompanying the preceding letter, exhibit so clearly the nature of the plan alluded to, as scarcely to require any explanation. It consists in inserting in walls, vertical columns of bricks, at short distances, to oppose the lateral thrust of the horizontal layers; either in one continued perpendicular line, as in fig. 1; or in a zig-zag form, as in fig. 3; or

Fig. 1.







in the alternating manner represented in fig. 2, (the strongest method, we should think, of any). Every one must perceive, at the first glance, that a vast increase of strength is sure to be gained by such a plan of building; and considering, at the same time, how simple and cheap an improvement it is, we shall deem it surprising if it do not

speedily come into general adoption. It must, we think, have been owing to the existence of the patent, or to the want of assiduity on the part of the patentee, that it has remained neglected so long. We can imagine nothing more satisfactory than the following certificate of its capabilities:—

" These are to certify, that in order to prove the increased strength and public security which may be obtained by introducing into the inside of a brick wall columns of bricks vertically, instead of the usual practice of forming the work in horizontal columns, with the joints level throughout, there was erected, in the open air, in the month of July last, a vertical bond wall eight feet in length, six feet six inches in height, and thirteen inches and a quarter broad (as per fig. 1); and another of like dimensions, in the

Fig. 2.

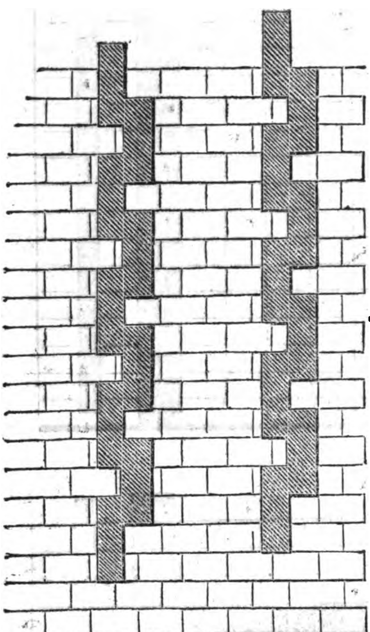
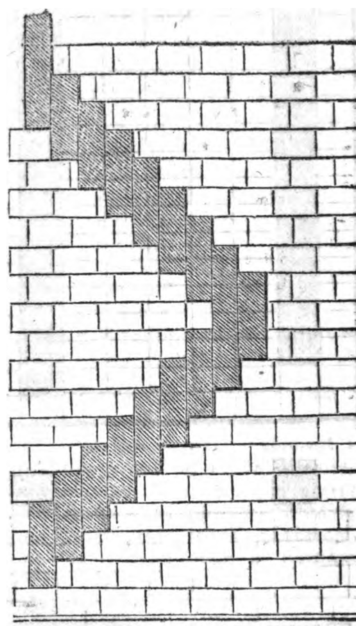


Fig. 3.



common method: against the top and bottom of each of them was placed a frame of wood, leaving five feet three inches in the middle unprotected; in the rear of this space there was attached to the wall two chains, which passed over an horizontal roller to a pendent scale board. The vertical bond wall was drawn forward to the side of the frame, five inches and a half out of its erect position, with a regular and gentle movement, by the application of 31 cwt. 22 lbs. When 22 cwt. 1 lb. was withdrawn from the scale, *the wall rapidly resumed its original perpendicular position.* The common wall was drawn forward to the frame by the application of 25 cwt. 3 qrs. 20 lbs.; making a difference in favour of the improvement, of 5 cwt. 1 qr. 2 lbs. This wall fell to pieces; being *quite broken!*

" We, the undersigned architects, surveyors, and builders, are satisfied that great additional *strength* and *public security* may be derived by

the introduction of the said improvement, and with great confidence recommend its application to the nobility, gentry, and to architects and builders in general.

(Signed) " C. Beazley.
J. Braithwaite.
R. Todd.
J. Fleming.
C. Middleton.
T. Bird.
J. Templar.
T. Thatcher.
J. Wright.
J. Savage.
Nevil Smart.
J. Stevens.
J. Cross.
J. Hughes.
J. Jones.
A. Clark.
G. H. Moteley.
F. Place.
W. Wilson.
C. W. Ward.
T. Richter.
J. Richter.
A. Mingay.
T. Stock.

" *Dated this 28th day of Nov.* 1812."

MR. LAWRANCE'S IMPROVED CALENDAR.

Sir,—On reading my letter descriptive of an improved self-regulating calendar, of which you have given so accurate and favourable an engraving, I perceive that I have omitted to mention, that the face being adapted to the present style, it is necessary when referring to dates prior to the 2d of September, 1752 (the time at which the style was altered), to place a piece of card board on the part allotted to the days of the week, of the same size and shape, and filled up as in the subjoined drawing.

For 399, second line, second column, front page, read 400; to 1999, fourth line, same column, *inclusive* should be added; for 227, same line, read 228.

It may not be improper in this place to remark, that the calendar mentioned in the concluding part of the same letter adapts itself to both styles, and to the changes that take place every 400 years.

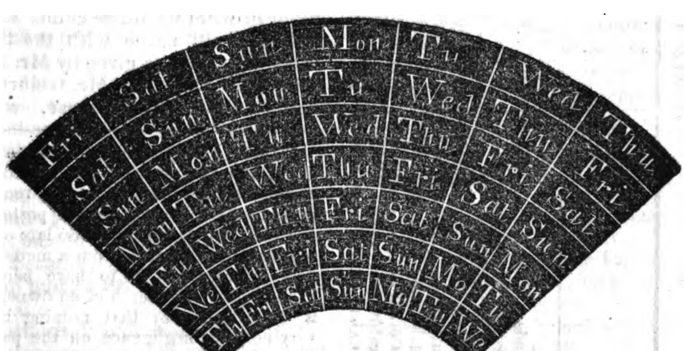
I am, Sir,
Yours, &c.
W. H. LAWRANCE.

March 18, 1828.

Sir,—I think there is a slight mistake in the *representation* of the face of Mr. Lawrance's calendar, in your 234th Number. The open space in the *face*, cut out to admit the different years, is not extended far enough, as it only admits 8, instead of the 11, concentric circles, on the revolving back part containing the dates.

Will Mr. L. favour us with the contrivance for altering it to any date whatever?

I am, Sir,
YOUR CONSTANT READER.



TABULAR VIEW OF THE SEVEN BRIDGES ACROSS THE THAMES, AT LONDON.

(Extracted from "Britton's Illustrations of the Public Buildings of London.")

	Length.	Width.	Height.	Arches.	Span of Centre.	Materials	Commenced	Finished.	Architects.	Waterway.	Solids.
	Ft	Ft	Ft	Ft	Ft						
1. London, Old	930	20	40	19	70	Stone and Rubble.	1176	1209	Peter of Colechurch	Above Starlings, 540 Below do., 273	396 657
Altered by Mr. Dance, and Sir R. Taylor	—	48	—	20	—	——	——	——	——	——	—
2. London, New.......	920	56	55	5	150	Granite, &c.	Mar. 15, 1824	Expected Mar. 1830	J. Rennie	690	92
3. Southwark	700	42	53	3	240	Iron	Sept. 23, 1814	1819	J. Rennie	660	48
4. Blackfriars	1000	42	62	9	100	Portland Stone	June, 1760	1770	R. Mylne	793	207
5. Waterloo	1326	42	54	9	120	Cornish Granite	Oct. 1811	Opened Mar. 1817	J. Rennie	1080	160
6. Westminster	1066	42	58	15	76	Portland Stone	Jan. 1739	1750	Labeyle	820	246
7. Vauxhall	809	36	—	9	78	Iron	July, 1816	July, 1816	James Walker	—	—

NOTICE OF AN ERROR IN GALBRAITH'S MATHEMATICAL AND ASTRONOMICAL TABLES, &c.

BY B. BEVAN, ESQ. CIVIL ENGINEER.*

When useful books, of condensed formula, are published with a view to shorten the labour of surveyors and engineers, it is of great importance to guard against errors; and the more so in proportion to the eminence of the authors.

In a late publication, of considerable practical utility, by Mr. Galbraith, of Edinburgh, at page 167, is given a copy of a rule from Mr. Barlow's "Treatise on the Strength and Stress of Timber," which is erroneous, and likely to mislead practical men, viz.

Prob. II. *To compute the deflection of beams,* FIXED *at one end, and loaded at the other, with any given weight.*

The proper note should be,

I. Multiply the tabular value of E by the breadth and cube of the depth of the given beam, both in inches.

II. Multiply the cube of the length in inches by the given weight in pounds, and that product again by 16 (instead of 32).

III. Divide the latter product by the former, and the quotient will be the deflection of the end of the beam in inches.

In the second edition of Mr. Barlow's treatise, I am aware there is a note intended to qualify the above rule, which is very defective, as no mode of what would be called *fixing* a beam will agree with the theorem. The rule, as given by Mr. Barlow, and copied by Mr. Galbraith, belongs to another case, which

* From a slight error ("56, instead of 55, Paternoster-row,") in the address of this communication, it only reached us on the 15th March, though posted on the 18th September last. So late as the 4th March, it appears, from a memorandum indorsed on it, to have been at "Glasgow" in search of an owner! It is needless to say that nothing but a very culpable negligence on the part of those through whose hands it has passed, could have occasioned its detention during a period of so many weeks.—EDIT.

either of the gentlemen might have found, if they had fairly tried the experiment; and in publications of this nature, no general rule should be published, that will not bear the test of experiment. The note at the end of the third problem, for beams *fixed* at each end, is perfectly useless, as it depends upon the manner of fixing.

Persons interested in subjects of this nature may see a valuable paper on the strength of materials, by Mr. Hodgkinson, in the *Manchester Mem.* vol. iv. p. 225.)

The numbers expressing the value of C, in the last column of the Table, p. 166, are very defective, owing, in a great measure, to the hypothetical mode of deducing from the supposed neutral axis. For instance: the direct cohesion of good sound English oak, if fairly tried, will be found double the strength expressed in the seventh column under the letter C; the same may be said of beech, and several others.

I am, Sir,
Yours, &c.
B. BEVAN.

ON THE TENACITY OF MALLEABLE IRON.

Sir,—In the summer of 1814, T. Telford, Esq. civil engineer, made above 200 experiments upon malleable iron of from 1-20th to 1 inch and a half in diameter, and on lengths varying from 31 to 900 feet.

These experiments were made perpendicularly, horizontally, and with different degrees of curvature. The results were, that a bar of good charcoal iron, one inch in diameter, will suspend 27 tons, and that an iron wire, 1-10th of an inch in diameter, will suspend 700 lbs.; and that the latter, with a curvature or versed sine of 1-50th of the chord line, will, besides its own weight, suspend 1-10th part of the weight suspended perpendicularly, when disposed at $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$, of its length; and that, with a curvature of 1-20th of the chord line, it will suspend $\frac{1}{4}$ of the aforesaid perpendicular weight, when disposed in a similar manner.

Experiments upon other diameters correspond sufficiently; and it was found that increasing the distance, only varied the effect by the difference of weight contained in the wire employed.

It was ascertained that a bar of good English malleable iron, one inch square, will suspend from 27 to 30 tons before it breaks, and that it bears from 15 to 16 tons before it begins to be extended in length.

I believe that Mr. Telford was induced to make these experiments, in order to ascertain correctly the strength of malleable iron when used in chains for bridges on the suspended principle.

I am, Sir,
Yours, &c.
TIM BOBBIN.

Manchester.

LONDON MECHANICS' INSTITUTON.

NO. XIII.

Lectures.

"All my ambition is, I own,
To profit, and to please unknown,"

Friday, February 1.—Dr. Birkbeck closed his Lectures on Anatomy, and intimated an intention again to resume them.

Wednesday 6.—Mr. Wallace on Mathematics.

Friday 15.—Mr. Hemmings commenced a course on Chemical Affinity.

Wednesday 20.—Mr. Brown commenced a set of Lectures on the History of the World.

Friday 22.—Mr. Hemmings.

Wednesday 27.—Mr. Brown.

Friday 29.—Mr. Hemmings.

The anniversary, which has been so long delayed, in order to meet the convenience of several distinguished characters who have promised to attend, is now postponed until the return of Mr. Brougham from the northern circuit. Sir F. Burdett, Dr. Lushington, Messrs. Denman and Brougham, and several other eminent gentlemen, have accepted the office of stewards; it is expected that the anniversary will be celebrated about the second week in April.

The evenings of the 8th and 13th were both occupied in long and warm debates on the Report of the Committee appointed to examine into the causes of the failure of the roof. The meeting finally adopted a resolution, proposed by Professor Millington, which expressed generally a condemnation of the course taken in erecting the roof.

It appeared, on the whole, that the Building Committee were led, or overruled, by one individual; so that they were more to blame than he, for allowing him to carry into effect that which they conceived to be injurious. The upshot of the business is, that the gratuitous aid of the architect has raised the first dissension in the Society, and cost its finances £290!!!

The staircase of the Institution is adorned with a list of the donors in gold on morocco, elegantly framed!

Ballot for Officers.

Tuesday, March 4.—Dr. Birkbeck was re-elected President; Professor Millington, Mr. Martineau, Mr. Peckston, civil engineer, and Mr. Toplis, surgeon, Vice-Presidents, (David Pollock, Esq. the barrister, and Mr. M'William, were the unsuccessful candidates); Alderman Key, Treasurer; and fifteen members committee-men.

Dr. Gilchrist, who has for some time past been in an ill state of health, resigned his office. It is almost a pity that Mr. Martineau should have been again elected, for he never attends.

Seventeenth Quarterly Meeting.

Wednesday, March 5. — Professor Millington in the Chair. Minutes of the last meeting read and confirmed.

The Quarter's Report of the Committee was then presented. It exhibited, in the first place, the following statement of the finances:—

	£.	s.	d.
Balance in hand at the commencement of last quarter	65	1	8
Receipts during last quarter	535	9	0
	600	10	8
Payments . .	531	0	6
Present balance	£69	10	2

The Committee felt pleasure in reporting, that notwithstanding the heavy drawback occasioned by the failure of the roof, they had succeeded in still further diminishing the outstanding debts, which are now as follows:—To Dr. Birkbeck, £3700; sundry small debts, in which is included the roof bill, £350.

Had it not, therefore, been for the expenses attending the failure of the roof, the amount of debts owing, exclusive of Dr. Birkbeck's, would have been but £50. Several additional donations have been received in money, books, and apparatus, including a fourth annual sum of £20 from W. Jones, Esq. who is still unknown (*applause*) except by name.

The number of members on the books at the end of the last quarter was	1238
Number of those who have ceased paying	330
	908
New members 309, and 30 who have paid up arrears . . .	339
	1247

showing a small increase on last quarter's numbers.

The Schools continue to prosper; no alteration has taken place in that department. The Chemical Class have completed one course, and will shortly commence another. A class is also formed for the study of Natural Philosophy as connected with Chemistry. The detail of the courses of Lectures delivered during the last quarter was closed by the agreeable intelligence that they had been all gratuitous.

The Report concluded by congratulating the members on the success of the Institution, and cordially thanking them for their kind and zealous co-operation.—(*Applause.*)

The Chairman now read the Auditor's usual half-yearly Report; which, with the Report, was unanimously received.

An amendment of the laws which had passed last quarter was, agreeable to rule, again submitted to the Meeting, and passed *nem. con.*

The following alteration on Rule 5, was then brought forward for consideration:—That the words "working class" be omitted, and the following substituted in their stead, "journeymen, or masters not employing journeymen or apprentices." As an amendment on this, it was proposed, that after the word "journeymen," the following words should be inserted—"comprehending masters working at their trade." A long and animated discussion followed, in which two journeymen—*bonâ fide* workmen—took a very active part. Many declared that little masters were not, by the present wording of the rule, excluded. Messrs. Richard Taylor, Hodgskin, and Professor Millington, took part in the debate; which was concluded by the rejection of both propositions—a conclusion which seemed to give universal satisfaction.

The usual thanks were then passed to the Lecturers, Officers, &c. and to Professor Millington, for his conduct as Chairman. The Professor returned thanks, and retired amid the hearty applause of the Meeting.

MISCELLANEOUS NOTICES.

French Building Regulations.—The dreadful accident that has occurred at the Brunswick Theatre, and the insecurity of the public, from the ignorance or negligence of individuals, calls imperiously for some legislative regulations similar to those adopted by the French government. In France, details of every part of the plan and construction of public buildings must be previously submitted to a government architect, who examines the whole carefully, and suggests the alterations and modifications which he judges necessary for the public safety: and it is only on his written approval of the plan that the construction is permitted to be executed. Nor does his charge end here; he superintends the works as they proceed, and prevents the slightest deviation from the plan as sanctioned by him. Had such a regulation existed in England, the calamity at the Brunswick Theatre would not have happened.

The paternal care of the French government, in whatever concerns the public safety and health, is admirable. In England, we hear continually of houses in a state of dilapidation falling, and entombing numerous persons in the ruins. In France there are regular inspectors who go systematically through Paris, to ascertain the state of the houses; and whenever the slightest appearance of danger is obvious, the tenants ore ordered to quit, and the place is pulled down. Private interests are never consulted, when the personal safety of the public is concerned. This *surveillance* is extended to the construction of all forges, furnaces, steam-engines, the manufactories of chemical products emitting offensive odours, &c. If a high-pressure engine be permitted in a town, one of the conditions is, that it shall be surrounded by a wall four feet thick; and the chimney must rise to a certain height above the adjoining buildings. The engine is not even permitted to be wrought, unless the boiler has been previously proved capable of supporting a power of steam four times greater than that at which it is intended to work. Besides these precautions, every boiler must be provided with a metallic plate, fusible at a small degree above the working power, that in case the safety valve should not act, or any other dangerous circumstance arise whereby the steam would become of a greater force than intended, the plate may melt, and the steam escape in abundance by the orifice. A few months since, a dyer, near Paris, who had a high-pressure engine, was interdicted working it, on account of the insecurity of the boiler. The proprietor ordered another to be made, and invited the officers of government to witness the proof of it at the maker's: it was intended to work at two atmospheres, and perfectly resisted the force of eight atmospheres; and was, consequently, approved. The proprietor, however, thinking to be too cunning, did not send for it, but had his old boiler cut shorter and used again. The government engineers, not suspecting the trick, did not examine the boiler when putting up. The engine had not been at work two hours, when the new end of the boiler was blown off at the rivets; the steam rushed out, and destroyed two houses in the rear; and the boiler itself was driven in a contrary direction, through the engine-house, to the distance of sixty yards; though weighing above two tons: it destroyed the engine, and killed the engineer and the proprietor, who happened to be in the engine-house. This accident arising from the wilful misconduct of the proprietor, his family was ordered to grant a pension to the widow of the engineer.—*Literary Gazette.*

Paddle-wheels.—Lieutenant A. Skene, of the navy, has recently obtained a patent for improved paddle-wheels, by which any velocity desired for steam-boats may be obtained, according to the power of the steam-engine; by this means, it is said, navigation can be carried on to the extent of thirty, forty, or even one hundred, miles in an hour; and most truly may the improvement which effects this be called *grand*—for really grand will be its effects, added, as no doubt it will be, to the invention of rendering the ships always buoyant by hollow tubes; and it will give us the power of exploring all quarters of the globe with safety, rapidity, and at reduced expenses.—(*From a Correspondent.*)

Invention of Gunpowder.—The invention of gunpowder has been generally attributed to Berthold Schwartz, a Franciscan monk of Cologne, who is said to have discovered this destructive compound about the 1380; but a late writer has shown that it was known to the Arabs more than one hundred years before that period, and gives the following receipt for the making of it, translated from an Arabic MS., written in the time of the crusades of St. Louis, and communicated by the Count Rzevuski to Mr. Von Hammer, in the *Mines de l'Orient*:—"Description of the composition put in cannons; viz. saltpetre 10, charcoal 2 drachms, sulphur a drachm and a half; pound it well, and fill with it precisely one-third of the cannon. Cause a rammer of wood to be made according to the calibre of the cannon's mouth, and introduce it with force. Next put in the bullet or the (flaming) arrow, and set fire to the powder contained in the bore of the cannon. It must be perforated to the depth of the touch-hole; for if it were perforated lower it would not only be defective, but destructive to him that fired."

Novel Punishment.—Solitary confinement in cells seven feet by three and a half, and seven feet high, together with hard labour at various cheap and easily-learned trades, is the system adopted in the jail of Cayuga county, in the State of New York: the head gaoler has a discretionary power to inflict whippings on the refractory; and to put any prisoner who obstinately refuses to work into a sort of cistern with a pump in it, where the water gradually mounts, so that if the man will not employ himself to throw it out he must drown. A late traveller asked if any convict ever had perished in this novel kind of bath, and was told it was not likely to happen; as in the few cases when the water had been allowed to reach the neck, the prisoner had begun plying the pump-handle most furiously, roaring out for assistance, in a terror that effectually precluded the necessity of his undergoing the experiment a second time.

A Mineral Spring—possessing all the qualities of that in the Long Walk, Windsor, (which was, by order of his Majesty, shut up, in consequence of the great public resort thereto,) has been lately discovered on the premises of Mr. Limer, distant from Windsor about a mile, on the road-side leading to Wingfield and Ascot Heath. It contains, in one old wine gallon measure, the following properties:—of muriate of magnesia, 16 grains; lime, 56 ditto; sulphate of soda, 152 ditto; carbonate of lime, 28 ditto.

Foreign Debts.—Hartlib, the friend of Milton pensioned by Cromwell for his agricultural writings, says, that old men in his days remembered the first gardeners that came over to Surrey, and sold turnips, carrots, parsnips, early peas, and rape, which were then great rarities, being imported from Holland. Cherries and hops were first planted, he says, in the reign of Henry VIII.; artichokes and currants made their appearance in the time of Elizabeth: but even at the end of this latter period we had cherries from Flanders; onions, saffron, and liquorice, from Spain; and hops from the Low Countries. Potatoes, which were first known in these islands

about the year 1586, continued for nearly a century to be cultivated in gardens as a curious exotic, and furnished a luxury only for tables of the richest persons in the kingdom. It appears in a manuscript account of the household expenses of Queen Anne, wife of James I., that the price of potatoes was then 1*s.* the pound.

Lightning Conductors.—It has been ascertained that iron, by acquiring polarity, loses a portion of its power as a conductor of electricity: and as all lightning rods placed in vertical directions are liable to acquire a considerable degree of polarity, it may be inferred, that in all such cases their protective properties are reduced. Dr. Fisher mentions an instance in which an iron conductor, in connexion with a powder magazine, so far lost its powers, as to allow of the powder exploding by a flash of lightning; and on examination, the rod was found to be strongly magnetic. Copper is the best metal for a lightning rod, though considerably more expensive than iron.

A Philosophical Vagary.—Mr. Bertholet, the son of the eminent philosopher of that name, was a young man of superior talents: his friends entertained high expectations of his future success; but neither the rank to which his father had attained, his own brilliant prospects, nor the literary society and amusements of Paris, could preserve him from *ennui* and weariness of life. He locked himself up in a small room, and closing the apertures and crevices, lighted a barrel of charcoal, and seated himself before a table, on which he had laid a seconds watch, with pen, ink, and paper. He then noted down, with exactness, the hour when the charcoal was lighted, the first sensation produced, and the progress of the delirium, till the writing became confused and illegible; and he was found dead upon the floor.

Invention of Mezzotinto.—The invention of this mode of engraving, is generally attributed to the following incident:—Prince Rupert, one morning, observing a soldier cleaning his musket from the rust occasioned by the fall of the night dew, perceived, upon examination, some resemblance to a figure corroded upon the barrel; and hence he conceived that some method might be discovered, to cover the plate all over with a grained ground, so that by scraping away the parts which required to be white, the effect of a drawing might be produced. He is said to have afterwards improved upon this hint, and, assisted by Wallerant Vaillant, to whom he communicated his thoughts on the subject, to have constructed a steel roller with sharp teeth, channelled out like a rasp or file, which answered in some degree the intended purpose. Aaron Heinnekin, however, a judicious and accurate writer upon the subject of early engraving, asserts (see his "Idée Générale d'une Collection complete d'Estampes," published at Leipsic, 1771,) that "it was *not* Prince Rupert, but one Lieutenant Colonel de Siegen, an officer in the service of the Landgrave of Hesse, who first engraved in this manner; and that the print which he produced, was a portrait of the Princess Amelia Elizabeth of Hesse, engraved as early as the year 1643. Prince Rupert readily learned the secret of this gentleman, and brought it into England when he came over the second time with Charles II."

Tunnel under the Vistula.—A project has been formed for the construction of a Tunnel under the Vistula; this mode of communication will be of the utmost utility, especially at the times of the breaking up of the frosts, when all intercourse is interrupted. The architect is a foreigner, and has engaged to complete the work in the space of three years.—*Paris Paper.*

New Life Boat.—A life boat, on the most approved construction, for the Lincolnshire Coast Association, has just been completed at the yard of Mr. Mason, in the Groves, Hull. Its dimensions are, length 27 feet, breadth 9 feet 6 inches, and depth 4 feet. It is to be stationed, for the present, at Saltfleet or North Somercoats, where it will be sent, with a suitable carriage, in a few days.—*Boston Gazette.*

Labour Lost.—A learned man of Naples, Martorelli, occupied himself for two years in writing a long memoir, in order to prove that the ancients were unacquainted with the use of glass for windows; and fifteen days after the publication of this folio, a house was discovered in Pompeii, all the windows of which were paned with glass.

The Olive Tree.—There are, on the southern borders of the Crimea, two varieties of the olive-tree, which have become indigenous there. The one is pyramidal, and its fruit is perfectly oval; the branches of the other are pendent, and its fruit large, heart-shaped, and abundant. These valuable trees have resisted the injuries of centuries, and of successive nations of barbarians. In 1812, an imperial garden was formed at Nikita (Russia), into which the cultivation of these useful trees was introduced by means of cuttings or slips, which no extremity of cold has hitherto affected, although some olive-trees brought from France perished in the same garden in the winter of 1825-6.

NEW PATENTS.

William Percival, of Knightsbridge, in the county of Middlesex, veterinary surgeon, for his new invented improvements in the construction and application of shoes without nails to the feet of horses and certain other animals.—19th January—6 months.

To John Weiss, Strand, surgical instrument maker, for improvements on instruments for bleeding horses and other animals.—Sealed 26th January—6 months.

To Augustus Applegath, Crayford, Kent, printer, for improvements in block printing.—26th January—4 months.

To Donald Currie, Regent-street, St. James's, Middlesex, for his method of preserving grain, and other vegetable and animal substances and liquids.—31st January—6 months.

To William Nairn, Dane-street, Edinburgh, Midlothian, mason, for his improved method or methods of propelling vessels through or on the water, by the aid of steam, or other mechanical force.—5th February—6 months.

NOTICES TO CORRESPONDENTS.

In consequence of numerous representations which have been made to us, that it would be a great convenience to Subscribers, to be able to transmit our weekly sheet through the medium of the post, it is our intention to commence the publication of a Stamped Edition in the first week of the ensuing month. As no more copies of that Edition will be printed than are ordered, persons desirous of obtaining it are requested to make us acquainted with their wishes, through the medium of their customary agents, as soon as possible.

J. H. to Sir John Sinclair, in our next.

Communications received from Mr. Brown—Mr. Wansbrough—J. G.—N. N. C.—Mr. Alexander—Robert John Thomas—Mr. Saul—Mr. Deakin—R. G.—Vulcan, Junior.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster Row, London.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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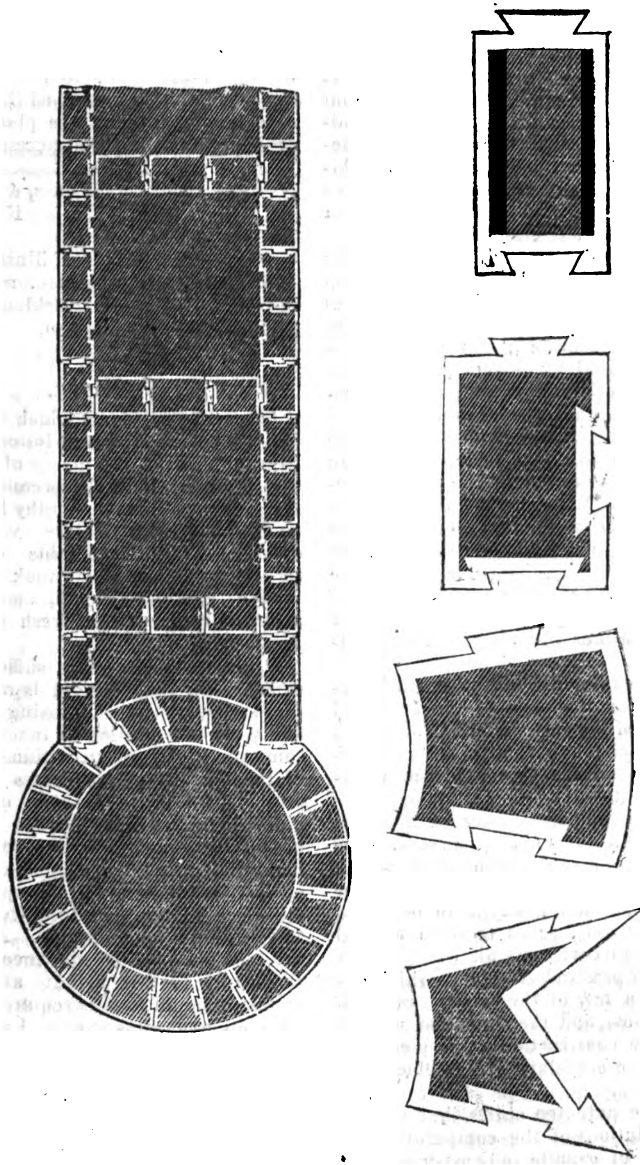
PATENT METALLIC CAISSONS.



PATENT METALLIC CAISSONS.

Sir,—A patent has recently been obtained by a Mr. Deeble, for the construction of piers, harbours, break-waters, docks, aqueducts, foundations, embankments, mill-dams, rivers, &c. &c. with "metallic caissons."

The invention is fully described in a pamphlet written by the patentee, and lately published; but, as that has probably fallen into the hands of comparatively few of your numerous readers, a brief sketch of this ingenious and apparently useful project may not be undeserving of a place in your Magazine.

The caisson is a hollow metallic box, open generally both at the top and bottom: the thickness of its sides is proportioned to the strength and gravity required; and the caissons are united by dovetails. In works of considerable extent, it is recommended that the caissons be seven feet long, five feet deep, and from two to five feet wide,—the width being regulated by the solidity required. In raising one tier of caissons above another, each tier is united to those immediately below and above it, by commencing the alternate vertical courses with a half caisson. The caissons intended for foundations are closed at the bottom.

In common dock or canal banking, the thickness of the front and back of the caissons need not exceed one inch; half that thickness is sufficient for the sides: in works exposed to a heavy sea, caissons of greater thickness may be adopted. The interior of the caissons, after they are erected, is to be filled with liquid lime and rubble, wet sand, or other suitable material to be found on the spot, so as to form a solid mass, girt with metal.

The prefixed drawings, which exhibit a few of the various forms of caissons, and their mode of uniting in the construction of a pier, will serve to elucidate Mr. Deeble's design.

The patentee states that various calculations of the comparative expense of granite and cast-iron caisson works, show an advantage in favour of the caissons of from 20 to 50 per cent. and upwards: and that walls constructed of caissons can be erected in one-fifth of the time required to build them with stone. The latter circumstance is obviously of very great importance in reference to works on the coast. It is also said, that many gentlemen, of the most undoubted scientific knowledge, have expressed their decided approbation of the plan, and anticipate its complete success.

I am, Sir,
Yours, &c.
F F.

A collection of models illustrative of Mr. Deeble's invention, may be inspected at Messrs. Buckland and Smith's, 3, Furnival's Inn.

FIRE ESCAPE.

Sir,—The accidents which so frequently occur, of persons losing their lives for want of the means of making their escape from premises on fire, are such as even apathy herself could not contemplate without emotion. The lamentable occurrences of this sort which took place, first, at Crutched Friars, and then at Clare Market, are fresh in the public recollection.

A moment's reflection suffices to convince us, that all that is wanted to preclude these distressing accidents, is the putting a ladder, or some such instrument, within reach of the persons whose egress is cut off by the fire. Exigencies of this kind being always of the most urgent nature, the means of affording relief under them must of necessity be such as we can possess ourselves of, and put into working trim, at a moment's notice. A ladder of ropes, with the means of raising it to any height at will, seems to be all that is required; as such an apparatus would, I apprehend, fully meet and satisfy the necessities of the case, as far, at least, as it is possible on so short a notice.

I shall now proceed to describe what I conceive these ought to be.

And, first, as to the ladder. This may be made in the usual manner, of good tight rope, not very thick, but to be made long enough to reach to the top of the highest buildings, and of the usual width and depth in the step. The head of it —and by means of which it may be attached to the sills of windows, and the like—to consist of two large iron or steel claws, semicircular at the upper end, and joined together at the lower, by two cross bars, some few inches apart, and one or two inches longer than the ladder is wide; so that, when not in use, the ladder may wind on to it; and thus going into small compass, it can be stowed away in any little corner, such as the top of a watchman's box. About the centre of these cross bars, small square or octagonal holes are to be made, by which it may be fixed on to the top of the apparatus for raising it. This is all that strikes me as being necessary to mention in regard to the ladder.

The next thing is to describe the instrument by which we propose to raise the ladder.

This is a very simple machine indeed, consisting only of a series of wooden tubes (except the highest, which is a solid piece of wood), drawing the one out of the other, after the manner of the sliding portions of a small telescope; only with this difference,—that the pieces, instead of being pulled out the whole way, like those, our instrument is to be so constructed, that when the piece is drawn out to its fullest extent, at least twelve inches of the lower end of each of the upper pieces is to remain within the top of the portion it is drawn out of, in order to strengthen the joint. The instrument may consist of any number of pieces or portions; but for the sake of easier illustration, we shall suppose it to be made up of no more than three—an upper, a middle, and a lower. The upper portion of the instrument, then, may be made of a solid piece of wood, of an octagonal shape, and about two inches in diameter, six feet three inches long, and alike thick throughout, except for one inch at the bottom, which is to be at least half an inch more in diameter, so as to act as a stop at top and bottom of the tube into which it slides. Thus, when five feet are pulled out, there will be one inch for this stop, and twelve inches to strengthen the joint, still left within the next following tube, or middle portion of the instrument; the remaining two inches are left outside, to pull it up by. Into the top of this first portion, a strong octagonal or other shaped spike, six or eight inches long, is to be driven, corresponding to the holes in the iron part of the head of the ladder. The second, or middle, portion of the instrument is to consist of a tube six feet two inches long, corresponding, inside and out, in form to the upper portion which we have just been describing, framed up of pieces of wood, and begirt with iron hoops indented into the wood, so as to leave the surface perfectly smooth, and such pieces to be about half an inch thick at the thinnest part. In the inside, a stop of one inch must be fixed at the bottom, to prevent the upper portion going too far down: then five feet upwards must be all of a width, and corresponding exactly to the stop upon the lower end of the upper portion; and the remaining twelve inches at the head must be of a less width, and such as will correspond to the size of the body of the upper piece, or portion, which is to slide up and down in it. The third portion of the instrument, and of course every other part, how many soever they may be, differ in nothing from that described, save that each must be one inch longer than the preceding, and as much wider as shall permit the preceding part of the instrument to slide in it. The several portions will thus draw out to the length of five feet. It may be of some advantage, perhaps, to have the lowest piece solid for at least four inches of extra length, under the lower stop; for the purpose of inserting a strong spike into it, which may be useful in steadying the instrument on the spot when being used. In the next place, in order to keep the several pieces in

position when drawn out to the full, or any intermediate extent, a very strong spring placed at the head of each tube, acting upon a set of ratchet teeth sloping downwards, indented into the side of the portion drawing out, will completely answer the purpose; as a spring acting on teeth so placed, will offer no obstruction while the pieces are being pulled out, but will effectually prevent it from sliding back again until the spring is held back, when the instrument is wished to be shut up. Lastly, in order to unhook the ladder from its position after it has served the purposes of its erection, let a short pipe of iron, with branches on each side, making something like the figure of a crescent, be provided, which, being fastened on the spike fixed at the head of the upper portion of the instrument, will serve the purpose very well. It is only necessary to add farther, that the wooden part of the apparatus ought to be made of ash, the growth of a high poorish soil, as such wood is always tough and close in the grain, and will, therefore, when properly seasoned, stand more strains and bear more tear and wear than any other wood so light.

Such is the apparatus I propose, and a very few words will suffice to evince its superiority for the purposes intended. In the first place, it takes up so little room, that when properly enfolded, it can be stowed away—the ladder on the top, and the instrument in the corner, of a watch-box; and thus it will always be at hand at a moment's call. When needed, it can be instantly produced by the watchman, as it is almost as portable as his rattle; and, being brought to the spot, affords the means of raising the ladder to any height in the course of a few seconds. Needs there more to recommend the adoption of a medium affording so feasible means of safe escape from one of the most horrid predicaments that ill-fated humanity can be placed in?

I beg further to mention, that since my thoughts were first turned to this subject, I have discovered the construction and materials of the pocket-ladder alluded to by the Marquis of Worcester, in the 50th of his famous "Century of Inventions." Most of your readers are aware of the very harsh terms in which this and several others of the inventions in the "Century" are spoken of by Lord Orford and some others; but so far as this one is concerned, I am bold to say such censure is most undeserved. The construction of it is certainly simple, and it might unquestionably be of service in the case under consideration. I should, therefore, feel much pleasure in laying the particulars of it before your readers; but I am convinced that the resurrection-man, the thief, and the whole tribe of nocturnal marauders, would lay hold of its capabilities for the furtherance of purposes abhorrent alike to the principles and the feelings of every honest man. Propriety, therefore, imperiously demands the suppression (for the present at least) of the knowledge of an instrument so liable to be perverted to bad purposes. The insertion of this will highly gratify,

Sir,

Yours, &c.

H. I*****.

[We have received three other Papers (by J. S. S., Mr. Baddeley, and Mr. Saul) on this interesting subject, which we design to insert in as quick succession as the other demands on our columns will allow. That of Mr. Baddeley consists of a review — extremely full, accurate, and instructive—of nearly all the plans of escape that have been as yet proposed; the present, of course, excepted, which seems well worthy of a supplemental notice from Mr. B. He will also find, in the forthcoming communications of J. S. S. and Mr. Saul, several useful hints well deserving of consideration.—EDIT.]

INCREASE OF FOOD FOR THE PEOPLE.

To Sir John Sinclair, Bart.

If your object had been, Sir John, to show the people how they might obtain a plentiful supply of roast

beef and plum-pudding, and every other good thing conducive to their comfort and their happiness, no one more than myself would have rejoiced in your success, or more cheerfully have added another feeble voice in praise of your benevolence.

The labouring people ought, Sir John, to execrate every attempt to raise cheap, insipid, and mawkish food for them. If it were possible, by means of any chemical process, to convert moss, turf, peat, wood, dust, and ashes, into food possessing nutritive qualities, to keep the bodies and souls of the poor working people together, that the race might not dwindle to nought; food, by which they might contrive to perform labour, and crawl on the surface of the earth as mere animal machines; food, that would *maintain* a family for one shilling a week;—rely upon it, Sir John, in a short time the wages of the poor would be reduced to this pittance,—for such is the feeling of pride which most Englishmen have—such their love of independence (or detestation of absolute dependence upon charity),—that they would rather live upon these presumed preparations, how insipid soever they might be, than have recourse to parish relief, or the poorhouse,—the wages of the whole of the working people would soon be reduced to the standard of "keeping soul and body together," *excepting* those particular trades bound by combinations not to work for less than certain wages. It is the distressing state of competition, or disunion, that reigns over the affairs of the working class, which has brought them so low in the scale of human existence; it is the absence of union amongst *them*, which allows the capitalist to live in plenty upon the fruits of their industry. I do not, Sir John, misinterpret your motives for being desirous to increase the food of the people—it is pure benevolence; but let me conjure you to seek out some method of enabling the working classes to increase their means of purchasing the *very best* food—instead of the worst; for, surely, if any persons in existence are entitled to the best, it is those who produce it, and all the comforts and elegances of life which we enjoy. I have now in the press, to be published by Messrs. Knight and Lacey, a small pamphlet, entitled, "The Emigrants;" it is to this humble performance that I beg to call your attention: it is written in language "simple and unadorned"—it is written to suit the comprehension of the poor and uneducated of society; but if your object be to benefit them, it will be no great sacrifice of time, nor will, I hope, be attended with great mental suffering, the perusing a production "not in keeping" with the elegant style of the present day.

I beg to be, Sir John, with the highest respect,

Your most humble servant,

J. H.

Exeter, March 5, 1828.

ON VIBRATION OF WIRES, AND COMPENSATING PIANO-FORTES.

Sir,—I should feel obliged to any of your correspondents for the easiest method of proving, that any wire which yields a sound by being made to vibrate, the tension being constant, will vibrate twice as fast when shortened one half. We know very well that the second sound will be more acute than the first, and will be what musicians call an octave above the sound given by the whole length. Mathematicians show that the pitch of a sound—or, in other words, its degree of acuteness—depends solely on the velocity of the vibrations of the body producing it; but what I require is for convincing a learner, who has not acquired mathematical knowledge, by some mechanical method easily comprehended.

Your correspondent, who has given a plan for a compensation pianoforte, in some recent Numbers of your interesting Magazine, will meet with some difficulty in the execution. The idea is not original; for Mr. Stodart, in Golden-square, London, has a patent for a pianoforte, in which a frame-work of metallic tubes bears all the tension of the wires, and keeps that tension nearly uniform, by expanding or

contracting at the same time as the wires.

Considering that common piano-fortes go soon out of tune, if the wrest-pins are not tight in their holes, I will ask also what kind of wood is best calculated to receive those pins, and hold them so tightly as not to be turned by the pull of the wires which are coiled round them? I believe that oak is commonly employed for this purpose. The iron wrest-pins have lately been much improved, by having a hole drilled through them to receive the end of the wire. As friction is the power which keeps the pins from turning round in their holes and slackening the wires, would not the friction be the greater, the larger the diameter of the pins?

I am, Sir,
Yours truly,
A. M. C.

Ulmisol, Feb. 20, 1828.

ASTRONOMICAL QUERY.

Sir,—I am sorry for having given "Astro Solis" even an imaginary reason to complain of a mis-statement with regard to the word "*must*," which, as he observes, was not used by him; but I cannot help thinking, at the same time, that it *must* be abundantly evident from my letter, that I did not rest my observations so much on the words, as on the general import of his communication: I do not mean that part of it which stated that the eclipses of Jupiter's satellites were computed for *mean* time, as it seems evident to me that "Rus Astro" was acquainted with that circumstance before; but I mean the latter part of his letter (vol. viii. page 224), which referred to the difference of the longitude. And I still think that to "Rus Astro," and to any other reader, this part of "Astro Solis's" letter must have conveyed an idea, that when the differences of longitude are stated in time, *mean solar* time is to be understood, and no other. Now, Sir, it was this false impression which I endeavoured to correct; and although I should be very sorry to give any one the least offence in so doing, yet I can by no means suffer the truth to remain concealed, in a thing that is in no degree hypothetical, and at the same time of some importance to the practical astronomer. "Astro Solis," in his reply (vol. ix. p. 13), speaking of Dr. Pearson's "Tables," says, "According to which, the reduction of 'Rus Astro' is correctly made, in respect to the difference between *mean solar* and *sidereal* time." Dr. Pearson's "Tables" are doubtless correct; and the reduction of "Rus Astro," if he meant to convert so many mean hours, &c. into the corresponding number of sidereal hours, &c. *was* correctly made: but if he intended,—and which I think he obviously did intend,—to reduce the *mean* time to the time shown by the *sidereal* clock at the same instant, then his reduction was *not* correctly made. For the sake of simplicity, suppose just three hours mean time past noon: if we convert these into sidereal hours, they will rather exceed three; but we are not to suppose that the hours, &c. thus found would show the sidereal time. They would only give us the sidereal time elapsed since mean noon, which might not have been the 0, or technical noon of the sidereal clock; for to suppose this to be the case on every day, is to make the sidereal clock take a backward leap, in order to start afresh at the mean noon,—a thing perhaps quite as ridiculous as expressing longitudes in the ununiform, or *apparent*, time. To be brief, Sir: I wish to be understood as stating a positive and incontrovertible fact, that when the differences of longitude are expressed in time, such time may be indiscriminately considered as *mean solar*, *sidereal*, or *apparent*, and reduced to equatorial arcs at the rate of 15° to 1 hour; and what we have to do is to ascertain, in any one of those species of time (the same of course at both places), the exact time at each place at some *absolute* instant,—the difference between which will be the same whichever time we use, and will give us the correct difference of lon-

gitude when reduced to the arc at the above rate.

If we required the time elapsed between the passage of one *terrestrial* meridian, from any certain *celestial* meridian, to the passage of some other *terrestrial*, under the same *celestial* meridian; then would the number of hours be different, according to the particular time in which it might be expressed: this, however, is not required in determining the longitudes of places on the earth. But if it were the case, and reduction to the arcs made at the rate of 15^0 to 1 hour, then must the differences be expressed in *sidereal* time; as is the case with regard to the right ascensions. With these circumstances, however, "Astro Solis" is well acquainted, as is sufficiently manifest from his note (vol. viii. p. 224).

In answer to any objections respecting our original subject, permit me to ask, Why did Mr. Brinkley determine the longitude of Dublin Observatory, by ascertaining, from several methods, the difference between the *apparent* time at that and at the Royal Observatory, Greenwich, at the same *absolute* instant? And why are the lunar distances set down in the "Nautical Almanac" for *apparent* time, and the longitudes ascertained at sea by finding the difference of *apparent* times? Surely it is because the differences of the times are the same, at any two places, in all the kinds of time. The eclipses of Jupiter's satellites, which were computed for apparent time till 1805, were not then changed to mean time, because the longitudes would otherwise be found incorrectly; but because the chronometers keep, of course, mean time, and the equation of time, therefore, need not now be applied.

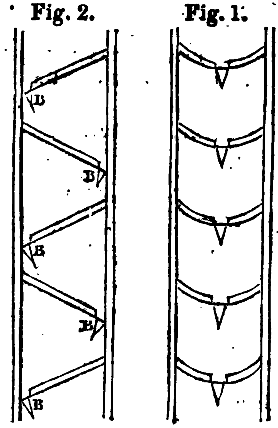
I hope what I have said will set the subject at rest; though I cannot, at present, know the contents of Mr. H——'s reply mentioned in your Notices to Correspondents, as I have the "Mechanics' Magazine" in monthly parts, which are sometimes a week after date when I get them; and which must be my apology for the very late arrival of any answer of mine.

I am Sir,
Yours, &c.
VECTIS.

Ryde, March 7, 1828.

ON THE COMPARATIVE MERITS OF THE DIAGONAL AND SEGMENTAL METHODS OF GLAZING HOT-HOUSE ROOFS.

Fig. 2. Fig. 1.



Sir,—Some of your readers will have observed, in No. 4 of the "Gardener's Magazine," a design for the diagonal glazing of hot-house roofs. The writer of that Paper, I believe, was not aware, at the time, that a similar plan was, and is, adopted in different parts. There appears, however, to be a great diversity of opinion as to which of the two plans, the diagonal or the segmental, is most likely to answer best. A gentleman in this neighbourhood, who is now building a hot-house, states that his carpenter and glazier are quite at variance on the subject; the one contending that the segmental is the best—the other, the diagonal. By your allowing both plans a place in your work of universal information, it may induce some of your readers, who have had an opportunity of seeing the merits of both put to the test, to give a candid opinion which is preferable.

Fig. 1 shews the segmental plan. About one inch in the middle of the cap is not bedded in putty, so that the dew and wet may escape from the inside of the house to the outside.

Fig. 2 represents the diagonal plan. Here there is not so much waste in cutting the glass; the dew and wet escapes at B, by that part not being bedded in putty.

I remain,
Yours, &c.
THE NORTH STAR.

Feb. 16, 1828.

PLAN FOR PROTECTING EARLY CROPS, RAISED IN FRAMES, FROM FROST.

BY MR. M. SAUL.

Fig. 1.

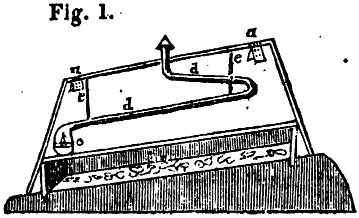
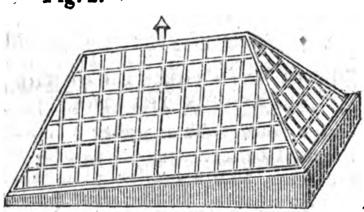


Fig. 2.



Sir,—In No. 12 of the "Gardeners' Magazine," page 417, a Correspondent complains of the great difficulty in keeping the frost from the early crops raised in frames. Now it appears to me, and will, I have no doubt, appear to others of your scientific readers, that the frames may be protected during the most severe frosts, and at a very trifling expense, by fixing a roof made of reeds, in the same manner as those used for protecting wall-fruit bloom, in spring, from frost.

With your permission, I shall endeavour to point out the advantage that may be derived from this plan. As Mr. Loudon recommends the "Mechanics' Magazine" for gardeners' libraries, and as it is within the reach of every class of readers that are in search of useful information, the present description can appear nowhere with more propriety, nor with greater chance of effecting good.

Fig. 1 represents the section of a roof and frame; *a a* the hinges, which, on the back and front being taken off, fold together; the ends are secured by one or two joint screws, as they are made to put up after the back and front are set up; *b* a lamp, which is for the purpose of raising a heat in very severe frost, and is to act as a stove; *c* the bottom of a stove, which may be raised up or down by means of a chain that supports the pipes; by which means the steam that may have arisen from the dung will escape through the stove, and pass the pipe out of the chimney at the top; *d* the pipe that conducts the heat to the other parts of the roof, and carries off the smoke; *e e* the chain that supports the pipe; *f f f* the inside of the frame, where the fruit is growing.

Fig. 2 is merely intended to show more fully the appearance of the frame, with this improvement: it is what the carpenter calls a hip roof.

I remain, Sir,
Yours, &c.
M. SAUL.

Lancaster, March 1, 1828.

APPEARANCE OF FIGURES IN ICE.

Sir,—The hypothesis of "Vectis," respecting the appearance of figures in ice (page 13), being founded upon a principle directly opposed to the well-known phenomena of nature, must necessarily be false. Water, in the act of congelation, so far from *contracting* and becoming *heavier*, *expands* and becomes *lighter*. If "Vectis" will freeze a phial full of water, either by exposure to a sufficiently cold atmosphere or immersion in a frigorific mixture, he will have ocular demonstration of the

fact, and consequent proof of the falsity of his hypothesis.

HENRY H.

ON FINDING THE CONTENTS OF PARALLELOPIPEDS IN BUSHELS.

Sir,—In Vol. viii. page 423, of the "Mechanics' Magazine," is inserted a short and easy way of finding the contents of a parallelopiped, in bushels, of floors, cisterns, &c.—I herewith send you another way of working the same question.

Multiply the length, breadth, and half the depth, into one, as before; cut off three figures to the right hand, and it will give the content of the floor 7 bushels too much in every 100; which excess may be deducted either by subtraction or multiplication. If you multiply the product by 93, you will have the true content; or if you subtract 7 bushels for every 100, ·7 for every 10 bushels, and ·07 for every single bushel, you will have the true content.

S. C.'s *Question for Example.*—Given the length of the floor 408, breadth 424, and depth 12 inches. Required the number of bushels it contains.

```
    324 breadth
    408 length
   ------
   2592
  1296
  ------
  132192
       6 half the depth
  ------
  793152 product
      93
  ------
 2379456
7138368
--------
73763136 content in bushels.
```

By Subtraction.

```
793,152 product
 55,52064
----------
737,63136 answer as before.

For 700    deduct 49.
     90       do.  6.3
  3,152       do.   .22064
  -----          --------
793,152           55,52064
```

The above analysis will fully explain S. C.'s new method of finding the content; as the excess, 7 bushels in every 100, may be deducted by either of the above rules, or by that given by S. C.

I shall be obliged to any of your Correspondents for a rule for finding factors, divisors, &c. for circular and square vessels, with the work at length, according to the new standard, or imperial measure.

A few questions worked by the simplest and easiest way, on gauging, mensuration, &c. (particularly artificers' work,) occasionally inserted in your pages, would be found beneficial to your numerous readers in general; as the books of arithmetic, by not having questions worked at full length, tend to puzzle and mislead those who have not had the benefit of a liberal education.

I hope the above will be taken up by persons who are more proficient and adequate to the task than myself.

I remain, Sir,

Yours, &c.

J. H——s.

Salford, Warwickshire,
Feb. 15, 1828.

INQUIRY INTO THE FALL OF THE BRUNSWICK THEATRE.

ADJOURNED INQUEST.

(Continued from page 136.)

March 20.

Mr. Richard Carruthers, the surviving proprietor, examined:—I never had any idea communicated to me that there was danger until the Wednesday before the accident. That day Joseph Blamire informed me he was afraid I did not know what was going on up stairs, as there was a warping in the roof, and the flies had sunk. I said, "Joe, who told you so?" He said he was desired to tell me by his stepfather West, for that there was a great jealousy on the part of Shaw, when any of the men spoke to me. I told him I was astonished to hear it. I sent for Shaw, and asked, "What is this? there is a giving way in the flies, and you have been tackling them up." He replied, that there was no danger: and I observed, "Don't tell me so; get some timber, and put some supporters to the flies, from the very foundation." He

said it should be done, and I was under that expectation. I dined at Mr. Maurice's, but feeling uneasy, slipt away when the cloth was drawn, and went down to the theatre, and asked for the carpenters, but there was no one there. At length, James Northwood, the porter, told me that Shaw had knocked off the men. I said, "Find me Shaw;" and he answered, that if I came, he was to tell me he had gone to Vauxhall, and I exclaimed, "I never heard of such a thing in my life." I asked Northwood if he could find me some of the carpenters, as I wished to have the supports put up that night, but he said he could not. Mr. Whitwell saw the flies tackled up on Monday night, but never told me. On the next morning I went down to inquire for Shaw. I asked Shaw why he had knocked off the men at so early an hour as half-past five o'clock, and he said it was usual to stop work at that hour during the Wednesdays and Fridays of Lent. He told me there was no danger; if he thought so, his wife would not be then upstairs stitching canvas. This quieted me. Shaw assured me that he was putting up the supports. I never interfered with the strength of the house, for that of course I left to Mr. Whitwell; a private gentleman not being a sufficient judge of such matters. To prove that I never interfered in the building, there was a brick pier which supported the proscenium post, which I wished, as it projected, to have removed: Shaw said it might be done, but I objected unless he had the authority of Mr. Whitwell; and he said Mr. Whitwell had no objection to its removal, and it was removed accordingly. I never knew of any weights being attached to the roof until the 26th of January, when Mr. Barlow, the contractor's London agent, being informed by a slater that there was a weight suspended to the roof, wrote to Mr. Maurice, and I observed to him that Mr. Whitwell must have seen it for some weeks. I then recommended Mr. Maurice to write to the manufacturer about it, and said I would leave the entire business connected with the roof to Mr. Whitwell and Mr. Maurice. When Mr. Whitwell came about the flies, he said that the inner one should not be carried up, and then told me that they were hanging things to the roof; my reply to him was, "Well, I have nothing to do with it; speak to Mr. Shaw or Mr. Maurice, who, I suppose, know what they are doing." If I had been the architect, and fancied that any thing improper was going on so as to endanger life, I would have called the proprietors to account, and given public notice of the danger. If Shaw had done his duty, and he and his men worked all night, according to my directions, no accident would have occurred. Since the calamity, Mr. Pulsford, in reply to my questions on the second day, while lying in bed, told me that he had informed Mr. Maurice and Mr. Whitwell, at a luncheon given by the latter gentleman, that there was danger in the roof. I then said immediately, "Why was not that told to me?" and he answered, that he was desired by some person, whatever he thought of it, to say nothing about it at present. I suppose this was occasioned by a wish to prevent any alarm going abroad. Shaw, I have heard, was warned by his workmen, who are ready to prove the fact; but he never informed me. When it was resolved to adopt the iron roof, it was the determination of me and my late partner to leave the sole direction of it to Mr. Whitwell; we left both the ordering and superintendence to him. Neither of us, to my knowledge, interfered, either with the manufacturer of the roof or his agent. While it was putting on, I did not go to the theatre above once a week. We had no further communication with Mr. Whitwell on the subject of the roof. Previous to its ordering, I desired him to look at other theatres, and see what it was to bear. I expressed my preference for a timber roof. During the progress of the building, I never knew that there were any truss-girders ordered, and consequently could not counter-order them. I will swear ten thousand oaths, if necessary, I never counter-ordered them, nor did any one in my presence.

The Coroner here observed, that all the written orders were signed—"D. Maurice, for self and Carruthers."

From the commencement I considered Mr. Whitwell as superintending the erection of the walls, and stage; and in that opinion I was strengthened by his interfering about the staircase, and altering the ceiling in the Green-room; but it was not intended that he should have any thing to do with the decorations.

Cross-examined by Mr. Hill, for Mr. Whitwell.—It was on Wednesday morning before the accident, that I first heard there was any danger. I saw it so pressing, that I gave directions for putting up the supporters. I was very angry at Shaw's absence. I did not mention to the actors on the morning of the calamity that there was any dan-

ger. The reason of my forbearance was, that Shaw's wife was in the flies, and I thought that there was nothing to be apprehended. I did not then send for Mr. Whitwell to tell him the roof had warped, neither did I apprize Mr. Barlow of that fact. Neither did I or Mr. Maurice ever desire Mr. Whitwell to superintend the machinery or the internal decorations. I only requested Mr. Whitwell to go and inspect Drury-lane Theatre, and see how the stage was constructed, and to look to the flies and shop floors. This was some time in the month of December last. When Mr. Whitwell complained of hanging the flies, I said, "I supposed that Mr. Evans and Mr. Maurice knew what they were about." On his making the observation about suspending weights from the roof, I did not understand him to say they were acting improperly, or that his remark was in the way of a remonstrance. I did say on that occasion, and it was the only time I had any conversation with Mr. Whitwell about hanging weights to the iron roof, that Mr. Maurice had a letter from the manufacturers, and I supposed they knew what they were about; "if not, do you look to the strength of the house." I don't recollect Mr. Whitwell saying in reply, "Very well, if you have the advice of other persons, it is of no use my giving my opinion.

Mr. Clarkson Stanfield, the artist, examined.—Was introduced by Mr. Carruthers to Mr. Whitwell, and at his request showed to him the internal arrangements of Drury-lane Theatre. He saw the machinery, carpenter's, and painter's shops, and flies, which were affixed to the roof, but which were also supported by beams that extended from the proscenium posts to the back walls. I am no architect, but have seen a great number of theatres in this country, France, Italy, and Flanders, and never saw one in which the carpenter's shops and flies were not suspended from the roof. At Drury-lane the painter's room is detached. I was in the Brunswick Theatre on the day on which it opened. The O. P. fly then gave way. I spoke to Shaw to prop it up. He raised it without tackle. I asked Mr. Whitwell if that did not alarm him, and he replied that he had nothing to do with the stage arrangements. I said, "What the deuce, is that the case?" Upon my oath I concluded he had the contract of the stage arrangements. I consider it to be the duty of an architect, while he is building the shell of a theatre, to see all that is placed within it.

Cooper, the carman, re-examined.—He brought the bricks, employed at the Brunswick Theatre, from Mr. Hobson's field, near Brixton; there were no malm-place among them, they were all washed stocks; the malm won't stand the weather; those in the entrance-walls were common stocks. The mortar will not adhere to washed stocks so soon as it will to the common: the washed cut easier. Has seen the depositions of the clerk of the works and the surveyors, and thinks that they have mistaken the quality of the bricks.

Mr. Whitwell, re-examined by Mr. Hill.—I mentioned to the proprietors, when an iron roof was agreed on, that a particular provision was to be made for the stage machinery quite distinct from that of the roof. I will say there was not any difficulty in supporting the entire of the stage department without touching the roof, or at all interfering with the working of the scenery. On my solemn oath, when I spoke to Mr. Carruthers about hanging a weight to the roof, he never used the words "that he looked to me for the strength of the building." Mr. John Sylvester was present on the occasion. Mr. Carruthers must have known, that when I spoke to him relative to the weights on the roof, I did so to remonstrate.

(*Again Adjourned till the 27th.*)

REMAINS OF ANCIENT WATER-WORKS DISCOVERED AT THE NEW LONDON BRIDGE.

Sir,—Among a great variety of curious articles which have been brought to light by the workmen employed in excavating the ground for the north foundation of the New London Bridge, are two cylinders, or pump-barrels, belonging to some water-works formerly erected on that spot: they are of cast-iron, four feet long, with a bore of 5¾ inches diameter; they are each furnished with trunnions, similar to a cannon, for the purpose of securing them in their places.

These forcing-pumps appear to have been immersed in the water from whence the supply was taken, the suction or feed-pipes being only four inches in length. The feed-pipe of one, and the delivery-pipe of the other, are of brass, very neatly united to the iron, by brazing. The

valves were not seated within the cylinders, *but in two separate chambers*.

It is extremely curious to observe, that a patent was taken out in December, 1792, by Mr. Charles Simpkin, engine-maker, for precisely the same arrangement. (See "Repository of Arts," vol. vii. page 301.) It is rather singular that this admirable invention of separate valve chambers should have been lost sight of so many years, viz. from 1582 to 1792 (a space of upwards of two centuries), and then re-discovered and brought forward again as a new invention; and such it undoubtedly was on the part of Mr. Simpkin.

With regard to the water-works, of which these two cylinders formed part, I am inclined to think they were those erected by "One Peter Morris, a Dutchman,* who, in the year 1582, contrived a water-engine, or mill, to supply the citizens with Thames water. This machine was first made to force the water no higher than Gracechurch-street. This engineer obtained from the City a lease for five hundred years, at the yearly rent of ten shillings, for the use of Thames water, and one arch, and a place for *sinking his mill upon*." (Allen's "History of London," vol. ii. page 467.) Stow, in his "English Chronicles," speaking of these water-works, says, "Peter Morris, free Denizon, conveyed Thames water, in pipes of lead,† over the steeple of St. Magnus church, at the north end of London Bridge, and so into divers men's house, in Thames-street, New Fish-street, and Grasse-street, up to the north-west corner of Leaden Hall (the highest ground of London), where the waste of the maine pipe ranne first this yeare (1582) on Christmas even; and since being divided into foure spoutes, oft times running foure wayes, plentifully serving to the commodity of the inhabitants neare, adjoining in their houses, and also cleansing the canals of the street towards Bishoppes gate, Aldgate, the Bridge, and the Stockes Market."

These water-works appear to have been buried in the ruins of the dreadful fire in 1666, when all the buildings on the waterside were destroyed. I am confirmed in this opinion by the appearance of one of the piston rods, which is of oak, and so large as nearly to fill the cylinder. The top is burned down some little distance within the cylinder in the shape of a cone, and from being charred is in better preservation than the other part.* I drew out from one of the cylinders a *half burnt cock*.

With the cylinders was found a large square iron shaft, which appears to have carried a cross arm,† to each end of which one of the piston rods was attached. The axes of this shaft are very much worn on the under side, as if from having performed a reciprocating movement in an arc of about 90 degrees.

Hoping this communication will be thought worthy of a corner in your valuable Magazine.

I remain, Sir,
Yours, &c.
W. BADDELEY, Jun.
10, *George-yard, Lombard-st.*

* I may observe, that the Dutch have always been noted for their skill in the construction of hydraulic engines.

† The delivery-pipe of one of the cylinders now discovered has a large *soldered* joint attached to it.

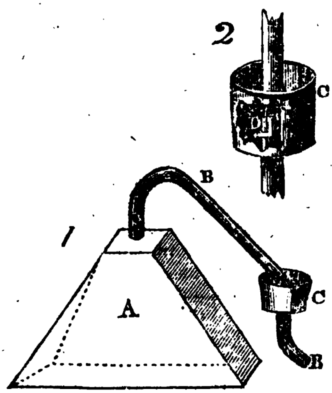
* This piston is at the bottom of its stroke; of the other one, which is at the top, the piston rod is missing, as if burnt away down to the piston: both pistons remain in their places.

† Probably one of timber, which was consumed in the fire, as nothing of this description has been discovered.

STEAM COOKING APPARATUS.

Sir,—Should you consider the following description of an apparatus which I have contrived for the purpose of obviating the inconvenience mentioned by your correspondent, Mr. Saul, in his communication respecting the "steam cooking apparatus of the Lancaster Lunatic

Asylum," worthy a place in th "Mechanics' Magazine," I shall feel obliged by its insertion.



A is a cover for the pans, having the pipe BB attached to its upper end. C is a small reservoir, containing cold water, which escapes from it by the jet D, fig. 2. The steam is thus condensed, and with the waste water runs off by the pipe B, and is either allowed to run to waste, or applied to whatever useful purpose circumstances may dictate.

Fig. 2 is an enlarged view of the reservoir C and jet D.

I remain, Sir,
Yours, &c.
HENRY H——.

Carmarthen, Feb. 18, 1828.

CASES AND INQUIRIES.

Mathematical Case. — Sir, — I beg leave, through the medium of your excellent Magazine, to submit to the consideration of your mathematical correspondents, the following question. It is from Macgregor's "Practical Mathematics,"—a work, I believe, now out of print; and, as it appears to me to be attended with some little difficulty, I shall feel greatly obliged to any of your mathematical students, who may be kind enough to favour me with a solution of the problem through your columns.

I am, Sir, &c.
ALPHA.

Question.

Suppose I have a circular enclosure of an acre of ground, how long ought a cord to be, that, fastened in the circumference of the enclosure as a centre, will strike an arch that will divide the said enclosure into two equal parts. Answer, 46·47898 yards.

P. S. Perhaps this problem may admit of a geometrical demonstration.

Fly Wheels.—Sir,—In the pages of your truly valuable Magazine for the last month, I observed a letter, written on the application of fly-wheels to machines, more particularly hinting how usefully they might be applied to horse-power machines. Unfortunately for me, I do not understand the calculations there given; they being entirely in "Algebra." If, therefore, your very intelligent correspondent will have the goodness to give me in plain *common English,* the SIZE, WEIGHT, and VELOCITY, a fly-wheel should be of, for a single horse-power, he will confer a great favour. I am about to erect a horse-mill, and will wait till your Number for March* shall appear. My wheel, or first mover, is sixteen feet diameter; the horse will walk two and a half to three turns per minute; the pinion is two feet diameter, consequently it will move about twenty-four times per minute. If the fly is placed on the axle of the pinion, would that velocity be sufficient? If not, would it be better to reduce the size of the pinion, or to increase the velocity of the fly by an additional wheel?

I believe I have stated exactly the difficulty I wish to get over—if not, let it be thus:—I have a horse-wheel sixteen feet diameter, my horse walking three turns per minute: it is intended to give motion to a circular saw revolving with considerable rapidity, and, in order to give a regular motion, I wish to add a fly-wheel. The question is—with what velocity ought the fly to travel *six times round per minute*—what diameter—and what weight? As I must be myself the engineer (having none resident near me) to erect this machine, your very intelligent correspondent will confer a great favour by helping me through these difficulties; and ere I conclude, Mr. Editor, allow me to return you thanks for the labour you bestow in getting up your useful Publication, from the pages of which my mind has derived many very valuable hints; and so long as you continue to publish, so long (if life shall last) shall I be one of your

GRATEFUL SUBSCRIBERS.

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* This inquiry has been in type for at least a month past, but omitted from time to time for want of room. We hope our correspondent will be able to wait yet another month, when he will doubtless receive the information he wants. ED.

Metallic Violins.—Sir,—Knowing your general readiness and impartiality in the insertion of your correspondents' wishes, I venture to solicit that you will inquire, through the medium of your very useful Work, whether it is practicable to construct a violin with thin plates of bell metal, or any other metal. Not being aware of any insuperable reason to the contrary, it struck me that by casting very thin plates from a good model, and having them carefully brazed together, an excellent Stradaveri or Amati might be, in a manner, stereotyped, at no great expense.

I am, Sir, &c.
PHILO-MUSICUS.

Black Lead Writing.—A Constant Reader of the "Mechanics' Magazine," (L. R.) wishes to inquire of its many ingenious and scientific correspondents, whether they are aware of any method or external application to common writing paper, by which black lead pencil writing may be rendered not only more legible, but also more durable than usual. L. R. is a very poor man, whose business obliges him to make many hasty memorandums of this kind; and which, whether he use a very hard pencil or not, he finds very soon become either faint or illegible. Is the preparation of the metallic paper (with which a pewter pencil is used) any great secret? That would quite answer L. R.'s purpose, but it is unfortunately too expensive for his purse.

['L. R." is recommended to consult the articles on the subject of his inquiry at pp. 256, 293, and 365, of our last volume ?—[ED.

Leather Bands.—Sir,—Permit me to ask, through the medium of the "Mechanics' Magazine," if it be possible to obtain bands of leather or hemp, about ten inches in circumference, one inch and a quarter broad, and one-eighth of an inch thick, without a join; that is, of one piece of leather, without being laced or sewed together; such as might be employed for driving machinery. Any of your readers, who can inform me where they can be bought (if it be possible), or if and how they can be made, will oblige

AN OPERATIVE MECHANIC.

Question on Artificial Mother of Pearl.—Mr. Baddeley, in a communication through the "Mechanics' Magazine," No. 171, dated Nov. 20, 1826, describes a method for the preparation of this Japanese cement, or Rice Paste. Would he be kind enough to say of what consistence it should be made for different purposes, and how it may be ascertained when it has been sufficiently boiled? By what method can it be formed into vases, busts, figures, &c., or used for taking impressions? What is the process of polishing it when dry, and the means used to vary its appearance from Mother of Pearl to that of white marble or alabaster? Whether the rice flour procured at the shops be sufficiently genuine, and pulverized sufficiently fine for the purpose?

Diorama, Regent's Park.—Two new Views have this week been brought out at this delightful place of public resort. One, by M. Daguerre, represents a Swiss village embosomed in mountains; the other, by M. Bouton, the interior of the Cloister of St. Wandrille, in Normandy. The former we think equal to any thing which has ever been exhibited at the Diorama,—the effect is perfectly magical; the latter, compared with the interiors of Canterbury Cathedral, Roslin Chapel, &c. is greatly superior. In the printed description handed to visitors, it is said of this last, "In this picture are seen numerous effects of light and shade: the clouds move; the leaves of the shrubs which overgrow some of the ruins are agitated by the wind, and display their shadows on the adjoining columns; the sun appears and disappears; a door opens and closes in the picture, and in the view of the spectator." It is a pity, now that the mechanism of the Diorama is so well known, that such representations as these should be had recourse to. The leaves are *not* agitated, though they seem to be so,—it is an optical deception accomplished by very simple and obvious means; the appearance of moving clouds and occasional sunshine, is the effect, as every body is aware, of coloured screens interposed between the back of the picture and a strong light; and though a door does open and close in view of the spectator, it reveals nothing to his sight. The less the proprietors of the Diorama say about such mechanical devices as the shaking leaves and opening door, the better. Either the brush and canvas should have been left to produce their own impression (with the help always of the coloured screens, which are very allowable auxiliaries), or mechanical motion, if called in at all, should have been employed to far more purpose than it has ever yet been at these exhibitions. The paintings are of themselves always well worth seeing; and though one of the two now brought forward will disappoint those who have seen the former exhibitions, the other makes, by its superior excellence, ample amends.

MISCELLANEOUS NOTICES.

The Olive Tree—perfects its fruit as far north as the duchy of Milan. The city of Milan is in lat. 45° 28 N.; the medium temperature of its climate, nearly 55 degs.; but extreme cold is not known. It is the coldest climate in which the Olive is cultivated in Europe. It is not understood what degree of cold the plant will bear: perhaps not greater than 17 degs., at which the sap of trees begins to congeal. It is curious that the seeds of this plant will not germinate, until they have passed through the digestive process in the stomach of the Turkey, which divests them of their oil, and fits them for re-production.

Gravitation.—"The profound sagacity of Newton," says Professor Leslie, "discovered, that had the force of gravitation been inversely as the cube, instead of the square, of the distance, the planets would have all shot off from the sun in diffusive logarithmic spirals,—the eye of science thus catching a glimpse of the high design which presides in the actual constitution of the universe."

Coccus Polonorum.—A kind of grass called *Polygonum minus*, abounds in the deserts of Ukraine. Towards the end of the month of June, this grass is torn up by the roots, which are covered with maggots (*Coccus Polonorum*) of an oval shape, that become indurated as soon as they are exposed to the air. These maggots are sold by the spoonful to merchants. They are then pounded, and water, in which they are steeped, with a little alum, assumes the colour of the most beautiful crimson. The wives of the Cossacks dye their thread with them; and the Russian merchants buy them for their wives to paint their faces with. The Polish Jews and the Armenians sell large quantities of them to the Turks, who employ them in dyeing their silks, their moroccos, the tails and manes of their horses, and their own hair, beards, and nails. Dampier, in his "Voyage round the World," speaks of them at the same time as of cochineal. From an experiment made at Moscow, it appears that a pound of these maggots, which costs only one rouble, yields as much rouge as half a pound of cochineal.

Stammering.—A radical cure is said to have been discovered for this infirmity, by a M. Malbouche, whose secret has not yet been made public, but whom the King of the Netherlands has employed to give his aid gratuitously to all classes.

Sagacious Conjecture.—There was found on an amethyst (and the same afterwards occurred on the front of an ancient temple) a number of marks or indents, which had long perplexed inquirers; and more particularly as similar marks or indents were frequently observed in ancient monuments. It occurred to the antiquary, Peirese, that these marks were nothing more than holes for small nails, which had formerly fastened little laminæ, which represented so many Greek letters. This hint of his own suggested to him to draw lines from one hole to another; and he beheld the amethyst reveal the name of the sculptor, and the frieze of the temple, the name of the god. This curious discovery has been since frequently applied.

Popular Instruction.—It has been determined by the Philosophical Society of Copenhagen, to establish courses of lectures on experimental philosophy in Copenhagen itself, and in all the principal towns of Denmark; with a view to the improvement of agriculture, manufactures, and the arts; the whole to be under the superintendence of M. Oersted, who has been unanimously appointed Director.

Sonth American Vegetation.—At a late sitting of members of the Lyceum of Natural History of New York, some clover-seed was exhibited from that portion of South America surrounding Mexico, which, in that climate, acquires the astonishing growth of four feet in height within twenty-five or thirty days.

Cost of Coal Gas.—Mr. Brande, in a recent lecture delivered at the Royal Institution, took occasion to allude to the high price the public are charged for Coal Gas by the Gas Companies; and showed, by an estimate of the expense of a chaldron of coals and the cost of manufacture, that an exorbitant profit must be made by the Gas Companies, according to their own estimates of the expense of manufacture.

Conversion of Iron into Steel.—An Englishman, resident at Paris, is stated to have discovered a method of converting the very worst iron of any country into sheer steel. It appears that by the new process the steel acquires a greater degree of hardness than by the former methods, while it is also much tougher. A knife of steel, produced by this process, is described as of a temper to cut iron like wood!

Cure for Damp Walls.—Mr. John Murray, in one of his lectures on chemistry, has assured his auditors that he has discovered an effectual remedy for damp walls in dwelling houses. His process is, to wash the walls over with a painter's brush dipped in a saturated solution of alum! I have not much faith in this discovery, for I know that no leather so soon becomes damp as that which is prepared with alum, and that the appearance of moisture on the inside of walls depends both on the conducting power for caloric, and the porosity of the materials of the wall and the inside plastering. By another person, a wash of sulphuric acid has been recommended as a cure: but the only method that I have seen practised with success is, to cover the surface of the wall with a good coat of Roman cement, and to paint it with oil colour when dry.—A. M. C——.

Sir J. E. Smith.—This distinguished naturalist, the first President of the Linnæan Society, died on the 17th of March, at Norwich, his native place. From the year 1786, when he published his first medical Work, almost to the hour of his death, he devoted himself with indefatigable zeal to the study of botany, and other useful branches of natural history. The productions of Sir J. E. Smith, as an author, during the long space of forty-two years, fill a multitude of volumes, besides tracts, and contributions to scientific journals. He enriched the "Philosophical Transactions," "Nicholsons Journal," &c. by his pen; but the most of his detached labours were given to the "Transactions of the Linnæan Society," of which he may be said to have been the founder. Besides his translations from Linnæus and others, his principal original Works are, the "English Botany," in 24 volumes; the "Flora Græca" (in conjunction with Dr. Sibthorpe); the "Flora Britannica;" and a "Tour on the Continent."

Making New Wine equal to Old.—M. Bory de St. Vincent has, after repeated trials, discovered that the inclosing of wine in bottles, by parchment, or a portion of common bladder, instead of corks, has the effect of rendering its flavour, in a few weeks, equal to that of the oldest wines; from such covering possessing the property of only allowing the aqueous exhalations to escape, but being wholly impenetrable to the spirit or body of the wine.

Patronage of Science.—Mr. Fuller, of Rosehill, (by his familiars called "Honest Jack,") whose patronage of the Royal Institution was before very substantially shown by a donation of 1000*l*., has recently evinced the continuance of his regard, by presenting a gold medal, of some ten guineas intrinsic value, to each of the principal persons who have distinguished themselves by chemical discoveries, in connexion with this

Society. Sir. H. Davy, Dr. Wollaston, Mr. Hatchett, Mr. Brande, Mr. Farraday, Mr. Daniell, Mr. Children, and others, have severally received these grateful testimonies; which are from the dye of Wyon, and worthy of his skill. The obverse is a fine head of the English father of true philosophy, Bacon; the reverse, a wreath of laurel, surrounding an inscription—"*For Chemical Discoveries: given by John Fuller, Member of the Royal Institution.*

Patronage of the Arts.—Mr. Soane, the architect, has presented the sum of 500*l.* to the British Institution, as a token of his anxious desire to promote the Fine Arts—a princely donation, worthy of a person who has himself derived a splendid fortune from the cultivation of the arts. The Governors of the Institution, have requested Mr. Soane to sit to Mr. Jackson for his portrait, to be preserved in the Gallery as a memorial of his munificence.

Vitrified Sand Tubes.—When thunder-bolts fall upon a sandy soil, their intense heat changes the sand through which they pass into a tube of glass. Several tubes, thus produced, one of which was *nineteen* feet long, have just been presented to the French Academy of Sciences, by M. Arago. These curiosities were collected in Germany, by M. Fielder, a young German naturalist.—*Weekly Review.*—Curiosities indeed! We suspect our contemporary has been imposed upon.

Conductibility.—Roll thin writing-paper round a brass or other metal rod, and hold the papered part over the flame of a spirit lamp; the paper will not be singed, nor otherwise injured, owing to the conducting power of the metal on which it is laid. A person made a steel escapement-wheel for a clock, and intended tempering the points of the teeth, by means of a blowpipe; but he failed, owing to the conducting power of the rest of the wheel.—A. M. C.

Angora Cats—are commonly but erroneously termed Ango*la*. Even in some modern works of science, this vulgar pronunciation is followed. Angola is on the western coast of Africa, and Angora is in Asia Minor, not far from Smyrna. It is at this latter place, and in its vicinity, that the beautiful Angora cat is found, whose long and silken hair is manufactured into camlets.

Heat and Hydrophobia.—In Egypt, as well as in other parts of Africa, and in the hottest parts of America, dogs are never attacked with hydrophobia. It has been hence inferred, that the common notion of canine madness prevailing most in the dog-days is erroneous; but the inference seems at least a hasty one. Excessive heat may naturally be expected to have an effect on the dog of a cold climate, very different from what it has on an animal born and reared under a perpetually burning sun.

Substitute for Razors.—The Turks employ a composition called *rusma*, for the purpose of shaving, instead of razors. It consists of seven parts of quick lime, mixed with three parts of orpiment. When they mean to apply it, they retire to some very warm place, such as the stove-baths of the East, in order that a copious perspiration may be induced. The mixture is diluted with water, and rubbed gently on the chin. A few moments after they try if the hair is detaching itself; they then take it off, without feeling any pain, and wash in warm water. Care is taken not to let the paste remain on too long, lest it should burn the skin. The hair is not prevented by this operation from growing again, and after some time it is found requisite to repeat the operation.

Edinburgh Monument to James Watt.—The Committee appointed to conduct the Subscription for the erection of a Monument to James Watt in the capital of Scotland, have issued a circular, soliciting aid in the prosecution of this object, which is in every way so honourable to the country. It is intended, that the Monument shall not only serve to transmit the name of Watt to posterity, but shall be applied to the purpose of conveying instruction, in the scientific principles of their trade, to operative mechanics, by the erection of a suitable building for the School of Arts. From the day of taking possession of the intended edifice, the present name of that establishment is to be dropped, and it is thenceforth to be called "The Watt Institution;" thus impressing on the minds of the students, by his great example, the high reward that awaits the industrious mechanic, whose genius is guided by the accurate principles of science, and by that practical wisdom which knowledge alone can impart. We are glad to see that the Committee recommend that the application for subscriptions should not be confined to the wealthier classes, but that all operative mechanics should be invited to assist, in proportion to their means, to do honour to a man who raised himself from their own sphere to this great distinction.

Coal Mine Explosion.—An explosion of choke damp took place at the Jarrow Colliery near Newcastle, on the 16th inst.; by which, we lament to say, eight persons lost their lives. It appears that the mine was known to be in a foul state; and that notwithstanding, candles, which it is wrong to use in any coal mine, were openly used. The "Tyne Mercury" in noticing the accident, remarks, that "the safety lamp, as it has been improperly called, has, we are afraid, proved in many cases a curse rather than a blessing. That it cannot protect the miner effectually from explosions, has been proved repeatedly. That it was an improvement on the former system, may be conceded; but it is a *test* only to show the existence of danger, not to prevent it. Even in this respect its operation has been mischievous. It has induced the owners of coal mines to carry on their works in dangerous places, where without the lamp, they would never have ventured." This is strong language but we believe there is a good deal of truth in it. We think, with the Editor of the "Tyne Mercury," that "it is much to be lamented, that none of the plans which have been prepared for more effectually *ventilating* the mines should have been tried. They may possibly not answer the purpose; but it is a duty the coal owners owe to humanity, to make the attempt."

Messrs. Applegath and Cowper's New Printing Machine.—The new press erected at the Times Office, by which 4000 sheets are printed per hour (on one side), is described as consisting of four printing cylinders, made to rise to let the form of type pass, and to fall when they are required to give the impression: they are supplied with paper by four lads; the sheets, after receiving the impression, passing into the hands of four other lads.

NOTICES TO CORRESPONDENTS.

Subscribers, in possession of incomplete sets, are informed that a small stock of odd Numbers is still on hand, out of which they may probably be supplied with what they want at the original price.

Communications received from Mr. Brown—F.—Mr. Barnard—W. C.—Mr. Curtis—T. E.—Jacob—A Constant Reader—Suffolkiensis—Ignis.

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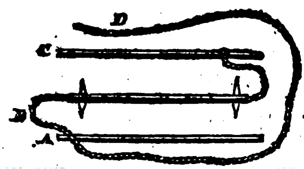
PORTABLE FIRE ESCAPES.



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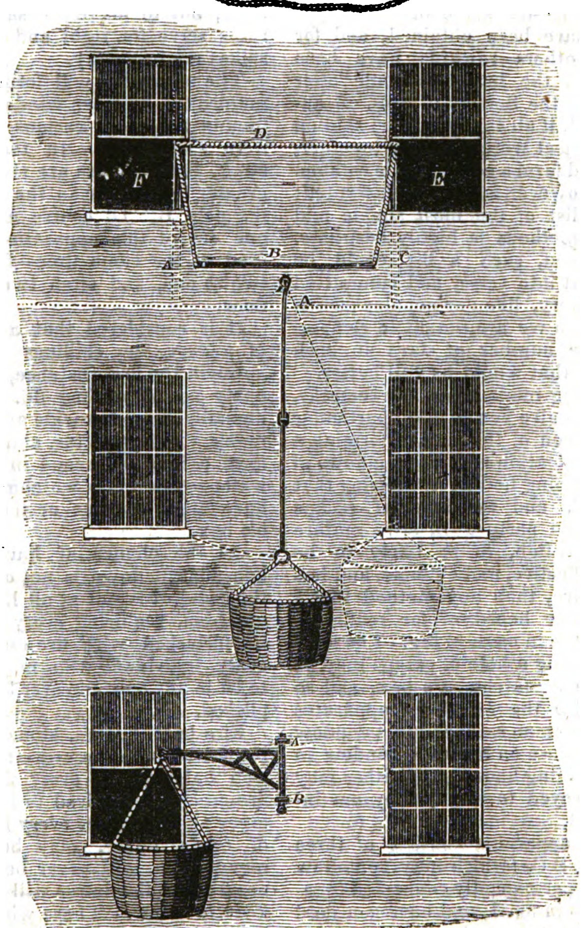

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PORTABLE FIRE-ESCAPES.

Sir,—It is desirable that every individual should be acquainted with the most simple and efficient means by which persons in a house on fire may assist themselves, or be rendered assistance, to escape, by others. It probably may with safety be inferred, that few, if any of those who recently suffered, or those who came to their assistance, had any (or, if any, very limited) knowledge of the various methods which have been proposed,—for some of which patents have been obtained, and for many others rewards have been given to the inventors, time after time, by the Society of Arts. I apprehend, if all that has been said on this subject were collected together, it would form a considerable volume. This, however, is not what is wanted; but a list of the most simple and useful methods is highly desirable. If, indeed, such a list could be wrought into verse, and committed to memory, like our popular distich by which we are taught to remember the number of days in each month, that would be still better.

Having made these few remarks, I beg to give you a more particular description of the plan of forming a communication with the windows of an adjoining house; conceiving that method, and the hole of escape through a party-wall, after mature consideration, to be likely to be more effective, more simple, and less expensive, than any method that I have ever heard of for rendering assistance in cases of fire. The tools for forming a hole of escape may be kept in a watchman's box, and so may also the necessary apparatus for forming an escape from a window of the house on fire to a window in an adjoining house; and either may be conveyed to the spot by *one* individual.

The apparatus consists of three rods, A B C, (which may be hollow tubes,) permanently connected together, as in fig. I, and having a cord D about ten or twelve feet long. The watchman, or other person, who brings the apparatus, is supposed to be at the window E, fig. 2, from which he hands the rod A, fig. 1, to a person at the window F, who takes it in, and places it in the position shown. Then the person at E pulls tight the rope D, and fastens it to the rod C, which completes the fixing of the apparatus. The rod, or pole, B, has two spikes on each side, about four or six inches long, to keep it at a sufficient distance off the wall for walking upon. Two spikes would be enough, if the windows were always similarly situated; but to make the same apparatus serve for right and left, four spikes are necessary.

The apparatus will form a communication between windows in adjoining houses at various distances from each other. In the sketch, fig. 2, the windows are shown at a greater distance than the length of the pole B. Of course more than one set of this apparatus may be used at the same time—frequently two at one, and often two at each floor.

It is considered that a payment of a very few shillings for every house in the first instance, and probably not exceeding 6d. per house annually, would provide and keep in repair this apparatus, and tools to form a hole of escape in a party-wall; so that every watchman might have either the one or the other in his box.

As the chance of having your house burnt down is not one in one thousand, it is not at all likely that any plan, requiring every house to be furnished with fire-escapes for every individual who may happen to be in any one, can ever be accomplished.

Fire-proof houses, stone, or other incombustible staircases, trap-doors, iron balconies at every floor, and fire-escapes, contrived to be kept in every apartment for every individual of every house, may be recommended, but will never become general; and the latter will never be kept in order. Those who are the least likely to adopt any such suggestions are, perhaps, the most likely

to have their houses destroyed, and the lives of individuals endangered, by that devouring element—fire.

The public attention, or that of any society, ought, perhaps, therefore, principally to be directed to such fire-escapes as are applicable when no means of escape have been provided. The two methods which I have already suggested are, I think, of this character.

I beg, however, to describe two other methods by which persons may be passed from a window of a house on fire to an adjoining house, with the least possible previous preparation: the first requiring only one permanent fixed piece of iron in the external face of the wall, between the windows on each floor of annexed houses; and the second, only two.

Fig. 3. A is the fixed hook on which the portable pendulum rod, with a basket at the bottom, being brought by the watchman, or other person, is suspended.

Fig. 4. A and B are two fixed eyes, or staples, forming sockets for the top and bottom of the portable crane. Either the pendulum or crane may be fixed in almost an instant after the person arrives at the proper window in the adjoining house. The sketches will, for the present, it is supposed, sufficiently explain these plans. The crane is the suggestion of one of my sons, between nine and ten years old.

For these two last plans, as every house would require at least two sets of the permanent fixed bolts, or eyes, the first expense of a general application, although vastly less than any other method of which I have hitherto heard, would be much greater than either of the two plans first described. The advantages of figs. 3 and 4, when compared with fig. 2, would be, that many could venture into the basket who would be fearful to walk on the pole; and, if compared with the hole of escape, the expense of repairing that hole would be saved.

Perhaps some of your readers, who may have witnessed either of the late fires, could say, if any of these plans had been adopted, whether the lives lost might have been preserved.

Watch-boxes are, I think, the proper repositories, and watchmen, if properly instructed, would be the fittest persons to convey such portable fire-escapes as I have pointed out to persons in danger; and I think any plan that will be attended with greater expense than such as these, or that would require another set of nightly watchers, will never become general.

It is considered unnecessary at present to enter into all the details of the four plans which I have now laid before your readers; but if any society or parish will undertake to carry my plans into effect, so that every house may have prompt and effective assistance in case of fire, I shall be prepared to give the requisite information. Whether any general plan can be proceeded with, either by a society or parish, without an Act of Parliament, I do not know: if such be necessary, no time ought to be lost. Let us not wait until another and another destructive fire urges us to a duty, which every one is convinced has already been sufficiently long and loudly called for.

Trusting that these discussions, on a subject of so much importance, will have a tendency to produce some general plan of operation ere another fire occurs,

I remain, Sir,

Yours, &c.

J. S. S.

RAIN GAUGE.

The following simple mode of constructing this valuable instrument is given in the "London Journal."—Take a funnel, whose opening is exactly ten square inches, and fix it in a bottle: as the rain descends, it will fall into the funnel, and from thence into the collecting vessel. The quantity of rain caught is ascertained by multiplying the weight in ounces by ·173, which gives the depth in inches and parts of an inch.

SAFETY CARRIAGES.

"'Tis hard if all is false that I advance,
A fool must now and then be right by chance:
Not that all freedom of dissent I blame;
No—there I grant the privilege I claim."
COWPER.

Sir,—I perceive, by No. 229 of the "Mechanics' Magazine," that your highly sensible, and, I believe, one of your oldest contributors, "T. M. B.," has attempted to show that my opinions concerning the safety which carriages might derive by the adoption of the plans which I have had honoured by insertion in your work, are all erroneous; but though he makes numerous assertions, he produces almost no proofs in their support. I shall now endeavour to make it appear that his objections, which, if true, would be insuperable, are unfounded.

Plan 1, "T. M. B." says, "would give way under the sudden drop of the coach:" but this is impossible, if constructed according to my direction; that is, sufficiently strong. He also says, that if made of *cast* iron it would snap: yes, if so made; but I, of course, took it for granted, that none would imagine that it should be made of that material. He says farther, that it would appear "inelegant;" but here, as Cowper says, his

"logic's misapplied,
To prove a consequence by none denied."

Plan 2, "T. M. B." says, is subject to the like objections; therefore to them the above replies are applicable.

Plan 3. Against this "T. M. B." says, that the iron bolt would bend or break by the jerk; but it would not, if made sufficiently strong, as I proposed that it should be. Even had I not done so, were a coachmaker desired to construct a coach, with these four plans for its safety, he of course would make the materials stout enough to conquer any opposition which they are liable to encounter. He also says, that it might break the spoke; and the sudden stop would cause a serious disarrangement in the whole coach. In my paper, containing these plans, I observed that, when the bolt was shot into the wheel, the coach should either stop, or go at a slower rate; but this remark, owing, I suppose, to some obscurity in my manuscript, was not inserted with sufficient distinctness.

Plan 4. To this "T. M. B." says, although the pole does, in a measure, pin them to the earth, it serves, in a great degree, to steady and give them confidence in their footing. But perhaps I can prove that it is not so, by the well known truth, that the wheel-horses fall much oftener than the leaders, who have no weight on them.

I am, Sir,
Yours, &c.
J.

THAMES TUNNEL.

Sir,—A "Young Engineer" wishes me to answer him some questions, which I will endeavour to do as follows:—

The *first question* he asks me is, "How the weight of the river is increased by the motion of the tides, &c.?" *(he should have said, upon the Thames Tunnel in particular).*

I answer, will the "Young Engineer" say that the water in the bed of the Thames is no weight upon an excavation of almost forty feet in width, with sometimes only a few feet of mud between it and the water? What resistance can such mud offer towards supporting the water that rests upon it? If he thinks this fair reasoning, he must certainly be aware that the motion of the tides rolling over the Tunnel will very seriously increase the weight upon the excavation.

Second question.—"How forty or fifty feet of earth would have prevented the water weighing one ounce upon the Tunnel?"

I answer, earth of all descriptions will admit of excavation, if there is a sufficient body of it; therefore a drift-way may be safely made, if carefully managed. The principal care should be, that no more earth is taken away, or suffered to sink from its natural situation, than is necessary for the

forming and securing, with mason work, the drift-way, or road, made through it. If mountains upon mountains were heaped upon it, they would not bear any particular weight upon the excavation—the surrounding earth bears the weight. But I think the "Young Engineer" had better consult Mr. Brunel himself upon this question; for he, in the Thames Tunnel, has had forty or fifty feet of earth between his Tunnel and the water. I doubt not but he would tell him, that at those distances from the water it did not bear one ounce upon the excavation. Mr. Brunel's opinion upon the first question may go far to convince the "Young Engineer" that I am right.

Third question. — "How the weight of the river upon the excavation of the single arches (or one-half of the present width) would not have amounted to one-fourth the weight as upon the present plan?" (He should have added, if the single arches had been as near the water as the double ones are.)

I will endeavour to solve this third question by the principles of long and short bearings. I will suppose one excavation forty feet, and another twenty feet, in width. Does not the "Young Engineer" understand that the bearing over twenty feet is four times as strong as the bearing of the same dimensions is over forty feet?

This principle applies only to the Thames Tunnel, where there is scarce any strength of earth over it, and not to a tunnel that has forty or fifty feet of earth between it and the water, as the *weight has only the sides of the excavation to support it.*

Fourth question. —"What is meant by saying—If the single arch were fifty feet under the bed of the river, the weight of it would be nothing upon the excavation?"

The answer to this is included in my answer to the third question.

Fifth question.—"How far from the water's edge would I find it convenient to have the entrances on my plan of tunnelling?"

That would depend upon the situation and other circumstances. There may be situations where the earth is so excellent, that a tunnel would admit of being driven safely nearer the water than fifty or forty feet. Under such circumstances the entrances would be much nearer the water's edge than where a greater depth is required. In some situations it may be most convenient to rise two inches per yard from under the middle of the river towards each end; consequently, the tunnel would go out to the surface sooner than at one and a half-inch, and be nearer the water's edge. I think the most useful and best road would be the one and a half inch; but never should the rise exceed two inches per yard from under the middle of the river towards both ends. If the "Young Engineer" will consult my plan of tunnelling, by it he will ascertain the length of any tunnel, under rivers, by the depth the tunnel may be from high water mark of the river, to the bottom of the tunnel under the middle of the river, at any rise per yard it may be thought proper to give the tunnel from the middle towards each end.

But I beg leave to tell the "Young Engineer," that no good road under any river in the world will be so short, or so handsome, as on my plan; for it embraces every advantage the form of the bed of the river will admit of. Mr. Brunel's plan does not do so; at his first entrance under the water, he has sufficient earth over his head, while in the middle of the river he has none. On my plan there would be nearly the same thickness of ground over the Tunnel from side to side.

Sixth question.—"On what principle of mining the Thames Tunnel is bad?"

I answer, from part of the excavation of the Tunnel being in the mud, where no man ever could have calculated or expected it to go. Another thing is, having the whole breadth of the work to take out under the aforesaid mud,—a breadth sufficient to place the two arches side by side.

I am, Sir, yours, &c.

THOMAS DEAKIN.

Blaenavon,
March 14th, 1828.

P. S. Through a delay in the transmission to me of the last month's Numbers of your Magazine, I only saw the "Young Engineer's" questions lately, otherwise I should have answered them sooner.

Erratum.—In looking back to the papers on this subject, we observe that, in a note on page 24 of the present volume, we blame the directors of the Tunnel for not calling "in the aid of such talent and skill as exists in the nation (of the advice of *Mr. Tredgold* for instance)." In the MS. the name was *Telford* not *Tredgold*—Mr. Tredgold is a gentleman justly held in high respect for his scientific attainments, but his experience in engineering has not been such as to warrant his being referred to as being before all others deserving of being consulted on an occasion like the present.—EDIT.

CURIOUS PROPERTY WHICH OBTAINS IN THE RECIPROCALS OF PRIME NUMBERS.

If the *circulating period* which constitutes the *reciprocal* of any *prime* number above 5, consist of any even number of figures, the *first half* of the *circulating period* will be the *complement* of the *latter half* to the number 9, and *vice versâ*.

When the remainder which constitutes the subsequent dividend, amounts to an unit less than the divisor, the *circulating period* is half obtained; and the following figures, or latter half of the quotient, will be the *complement* of the preceding or first half; the latter half may therefore be obtained by *subtraction*.

If the quotient is written out to *infinity*, and the first figure in the latter half of the *circulating period* be placed under the first figure or cypher in the preceding half, and the quotient figures be continued under them also to *infinity*, their sum, or value, will be equal to *unity*, and the lower line will be the *complement* of the upper one to *unity*; and *vice versâ*.

It is asserted in "Nicholson's Journal," vol. i. pp. 314—16, 8vo. that this law obtains *in all prime numbers not less than* 7; where the writer observes, that the result of the divisions of an unit by the prime numbers 11, 31, 37, 41, &c. appears at first sight to deviate from the general law above laid down; but in fact it is subservient to it; which he illustrates by an example.

Now, Sir, the *reciprocal* of number 11 only answers the conditions required.

The *reciprocal* of No. 31 contains a period of fifteen places before the figures in the quotient *circulate*; viz. ·032258064516129. No. 37 contains three places; viz. ·027·027, &c.; and No. 41 contains 5 places; viz. ·02439·02439, &c. As the *circulating periods* constituting the *reciprocals* of the numbers 31, 37, and 41, contain an odd number of figures, they consequently cannot answer the proposed conditions, but are a deviation from the general law given in the said "Journal."

In order to prove that the above law obtains in the prime numbers 31, 37, 41, &c., he gives an example in dividing by the number 41, as follows: $1 \div 41$, $40 \div 41$, $2 \div 41$, $39 \div 41$, $3 \div 41$, $38 \div 41$, $6 \div 41$, $35 \div 41$; all the above numbers divided by 41, generate a period of five figures in the quotient, when they are again repeated. Now all this proves nothing in confirmation of the existence of the above law; as everybody knows that the sum of the quotients arising from the division of 1 and 40, 2 and 39, 3 and 38, &c. divided by 41 respectively, must be the same as $41 \div 41$, that is, equal to unity, provided that after the division is effected there are no remainders: but as this is not the case, the sum of the relative figures in the respective quotients will amount to the number 9, and the sum of the remainders to 41; that is, the quotient of $1 \div 41$ will be the *complement* of the quotient of $40 \div 41$, and *vice versâ*. And if both quotients are added together, the value of each digit in their sum will be 9, and the sum of each respective pair of dividends or *remainders* will be 41.

Example.

41)1·00(·02439
82
180
164
160
123
370
369
1

41)40·0(·97560
369
310
287
230
205
250
246
40

Dividends $\left\{\begin{array}{l} 1 \div 41 = 1 \cdot 10 \cdot 18 \cdot 16 \cdot 37 \cdot 1 \\ 40 \div 41 = 40 \cdot 31 \cdot 23 \cdot 25 \cdot 4 \cdot 40 \end{array}\right.$

Sum 41 , 41 , 41 , 41 , 41 , 41

Quotients $\left\{\begin{array}{l} 1 \div 41 = \cdot 02439 \\ 40 \div 41 = \cdot 97560 \end{array}\right.$

Sum ·99999

The following examples are an illustration of the property which obtains in the *reciprocals* of *prime* numbers, when the *circulating periods* contain an *even* number of decimals' places:

Example 1.

Let unity be divided by the prime number 7.

7)1·0(·
1 ... 7
3·0
4 28
2·0
2 14
6·0
8 56
4·0
5 35
5·0
7 49
1

Dividends $\left\{\begin{array}{l} 1 \cdot 3 \cdot 2 \text{ first} \\ 6 \cdot 4 \cdot 5 \text{ second} \end{array}\right\}$ half

Sum 7 · 7 · 7

Quotients $\left\{\begin{array}{l} 142 \text{ first} \\ 857 \text{ second} \end{array}\right\}$ half

Sum 999

Let unity be divided by the prime numbers 17 and 19.

Example 2.	*Example* 3.
17)1·0·0	19)1·0·0
0·05 85	0·05 95
15·0	5·0
8....136	2....38
14·0	12·0
8.....136	6...114
4·0	6·0
2......34	3....57
6·0	3·0
3......51	1....19
9·0	11·0
5......85	5... 95
5·0	15·0
2......34	7....133
16·0	17·0
9 153	8....152
7·0	18·0
4......68	9.. 171
2·0	9·0
1......17	4....76
3·0	14·0
1......17	7.. 133
13·0	7·0
7 119	3....57
11·0	13·0
6 102	6.. 114
8·0	16·0
4......68	8.. 152
12·0	8·0
7......119	4....76
1	4·0
	2....38
	2·0
	1....19
	1

	1÷17	1÷19	
Dividends	1·10·15·14· 4· 6· 9· 5·	1·10· 5·12· 6· 3·11·15·17· first	half
	16· 7· 2· 3·13·11· 8·12·	18· 9·14· 7·13·16· 8· 4· 2· second	half
Sum=	17,17,17,17,17,17,17,17	19,19,19,19,19,19,19,19,19	
Quotients	·05882352	·052631578 first	half
	·94117647	·947368421 second	half
Sum=	·99999999	·999999999	

This curious property is peculiar to prime numbers, and to all such, and such only, as contain an even number of places in their respective quotients, when the figures begin to circulate; as it is evident they cannot otherwise be divided into two equal parts.

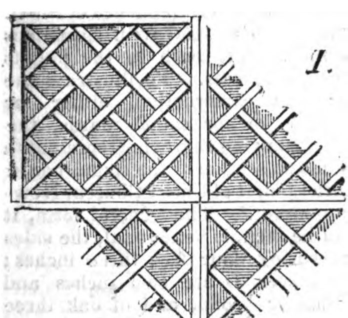
It will be seen by the above examples, that when the remainder is an unit less than the divisor, the circulating period (*) is half obtained. The latter half may therefore be had by subtraction; but the writer in "Nicholson's Journal" does not, however, notice this circumstance.

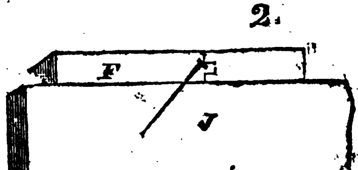
J. UTTING.

Lynn, *Jan.* 1828.

Remark.—The above method of placing the *quotient* is, I think, more simple, and preferable to the usual practice of placing the *quotient* on the right-hand side of the *dividend*, as the *product of the divisor and quotient* stand on the same line opposite to the *quotient figure* by which it is produced.

MARQUETING.





SIR, — Your correspondent, S. Cabot, who, in No. 232, inquires for the above article, I believe does it under a wrong name. It should be parqueting, or parquetry; he may find it described in "Chambaud's Dictionary," under the word parquet, as "*Compartiment de Menuiserie sur le plancher d'en bas.*"

How the floor is put together in St. Paul's library, which is usually described by those who shew it as put together without nail or peg, is what I do not know; but I rather doubt the correctness of the assertion.

When Carlton-house was fitted up, about forty years ago, the throne-room, and several others, were laid with a species of parquetry, similar to the sketch, fig. 1, above. It was prepared at Paris, and was sent to London in compartments of about three feet square. In fig. 1 is exhibited one whole compartment, and part of three others, to show the manner of joining them together. It was laid on joists of the common description; the compartments were joined to each other by groove and tongue, wrought with what is usually called match-planes, and were fastened to the joists by oblique nailing through the tongued edges, so that no nails appeared on the surface, as is shown in fig. 2, in which the edge of the floor, the groove and tongue, and one of the nails by which the floor is fastened to the joist, are shown.

The narrow diagonal pieces and square frame, on the outside, are put together with mortice and tenons, and grooved to receive flush pannels.

The grain, or fibres, of the wood composing the pannels, are put as shown by the lines in the sketch.

The wood of those floors was wainscot.

I am, Sir,
Yours, &c.
HENRY PROVIS.

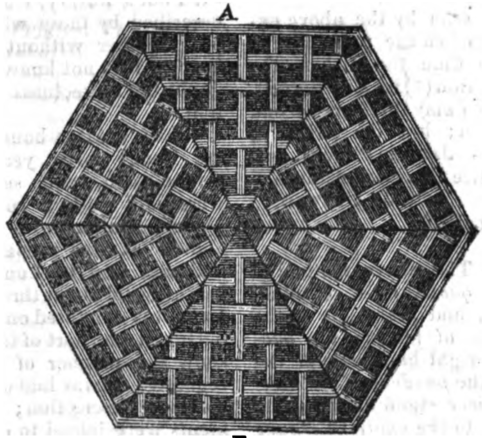
Sherington, *Bucks*.

On the same.

BY MR. C. DAVY, ARCHITECT, AND TEACHER OF ARCHITECTURE.

Marqueting, or marquetry (from the French), is a term applied generally to all sorts of inlaying, either

A



B

in gold, silver, or precious stones, the latter of which, according to its modern name, is now called Mosaic work. The art of marqueting, or inlaying, is of a most ancient date, being mentioned particularly in Holy Writ. From the description there given of the Jewish breastplate, it must have been a specimen of this art of the most costly description. Our neighbours, the French, are generally allowed to have been particularly famous for this branch of art; and its perfection may be said to have risen to its greatest height in the 17th century.

However, we have ample proof that in this country the native artists merely require judicious encouragement, to equal, if not eclipse, the skill of other nations. The library of the cathedral of St. Paul, the floor of the British Museum, and some of the new apartments at Windsor, &c. exhibit splendid instances of its successful application to the purposes of flooring.* The fifty new churches erected by Act of Parliament, and particularly those of them which were erected under the immediate superintendence of Sir C. Wren, also abound with specimens of marquetry, both in the pulpits and altarpieces. To illustrate the mode of construction, either for flooring or for sound-boards, the accompanying engraving represents a plan and section of the sound-board to the pulpit of Christ Church, Newgate-street.* The general form, it will be seen, is hexagonal, the sides measuring four feet three inches; the pieces D are two inches and a quarter broad, and of oak three quarters of an inch thick, lapped together and glued, as shown in the section, alternately, at every length of two squares, C C. These latter pieces are tongued, and the

* A superb specimen of inlaying was lately executed for the Earl of Abergavenny. A drawing of it is in the possession of the writer.

* The pulpit has lately been removed to the centre aisle, and the sound-board stands in the chancel. The method of removing and fixing the pulpit will form the subject of another communication; for which method, together with permission to examine the sound-board, we feel much indebted to Messrs. Nixon and Son, builders, of Warwick-lane.

pieces D D are ploughed on the sides to receive them, in the manner of pannels, allowing at the finish of the work for them to be all perfectly level; the squares C C measure four inches and a half, by three quarters thick. It will be thus perceived, that there are no nails or pegs wanted, unless for better security; it should, however, be dowelled *in a few places.* It is not uncommon, for the purposes of flooring, to lay a *light floor* under, and within a few inches of it, which has the effect of preventing it from being injured by any very heavy weight which it may chance to be loaded with.

C. D.

MR. WOOLLGAR'S SELF-REGULATING CALENDAR.

Sir,—Owing to accidental circumstances, I have not until to-day seen your 234th Number, containing a description of Mr. Laurance's "Improved Self-Regulating Calendar." It is natural for every person to have a good opinion of his own performances, but the public must judge whether my *original* form, or Mr. L.'s *modification*, possesses the greatest *practical utility.* Mr. L. seems to think much of having extended the period of years from 28 to 400; in order to effect which, he has changed my rectilineal compartments into a series occupying two-thirds of the circumference of a circle—a change which, in my opinion, much diminishes the facility of using the calendar for the *current year,* especially when suspended against a wall. Although I have put only 28 years upon my circle, it would be very easy, without altering the *form* of the calendar, to insert twice the number.

In a postscript to my description, I called upon your ingenious readers to explain why 24 compartments were necessary for the months. This has not been attempted by any one. Will Mr. L. condescend to do so?

I have been prevented, by want of leisure only, and not by disinclination, from taking part in many interesting discussions which have filled your columns during the last six months.

I remain, Sir,
Yours, &c.
J. W. WOOLLGAR.

London, March 29, 1828.

MR. LAURANCE'S CALENDAR.

Sir,—"A Constant Reader," (page 139,) thinks the index of my calendar is not extended far enough to admit of the eleven concentric circles. From a slight mistake in the engraving only 8 appear at the index; but if he apply compasses to the boundaries of the 11 concentric circles in the middle piece, and then to the index, he will find there is sufficient extent for the appearance of the whole. To prevent similar inquiries, it may be as well to observe, that the lower part of the index is made somewhat wider than the division, to admit of the pin entering the pinholes more freely. In mine, the dividing lines of the middle piece are drawn in black lead, to aid in entering the months and dates regularly; but are afterwards rubbed out, to avoid the unsightly appearance they would make at the index, if in the least degree out of their place.

Since my letter of the 18th ult., I have been led to a careful examination of my calendar, adapted to any date whatever, and find that the changes alluded to in the concluding part of that letter take place every century, instead of every fourth century; consequently, without the contrivance alluded to, the calendar in its more simple form is necessarily confined to the present century.

I would willingly comply with the latter request of your "Constant Reader," had I not already intruded too much on your valuable pages. An early insertion of the above will greatly oblige,

Sir,
Yours, &c.
W. H. LAURANCE.

March 26, 1828.

PERPETUAL MOTION—HOW TO PRODUCE IT.

Sir,—I have read much in your entertaining work about *perpetual*

motion, and I find that numbers of your correspondents deny its possibility. Now, Sir, it appears to me that nothing is so easy as the mechanism of its construction, provided any one will take the trouble of the execution. It doubtlessly can be done in a variety of ways, of which I shall mention two: First, Place a small windmill on the ridge of a house, or to the chimney-top corner, so that a thin silk cord can descend through a small pipe or cylinder through the roof to a chamber below; the hole must be large enough for the cylinder or pipe to rise and fall when required; and the line or cord within this cylinder, as its case, must move as freely. To an eight-day clock in the chamber below add a multiplying wheel of twelve, or any other greater number, at pleasure, and to this fasten the line from the mill above: in the middle of the length of this cord tie a small knot which will pass through the cylinder in winding up: and very near the end a large knot must be tied which will *not* pass through the cylinder, but, as it passes up, lift up the cylinder with it: on the top of this cylinder or pipe must be made a crutch, which, as it rises, must gripe or stop the mill; and also some side springs to the same cylindric pipe, which, as it rises, will spring out horizontally and prevent it from descending, something like the spear-head in a walking-stick when placed perpendicularly. These springs must rest on a plate which opens and shuts as a pair of scissors when held in a horizontal position.

Next, a lever must be so placed that one end of it must be over the cylindrical case, with a small hinge or valve, and a fork cut in it. The small knot, in ascending, lifts up the forked valve without any effect being produced, as it falls immediately the small knot leaves it; but, in descending, the small knot not being able to pass the valve without pressing the end of the lever down, the other end releases the sides on which the springs rest, by opening the plate as before said; by which means the gripe (or pin, if it should be preferred) instantly falls, and the mill is at liberty to go again the first wind.

The principle on which such a contrivance acts is, that when once the mill winds up the clock, it gripes itself, and so remains till it is half down, or till the small knot descending releases it; and if there is no wind then, it will keep going till the other half of the line is out, or its full time, which, in this case, will be about twelve weeks; for, when once wound up, it goes half its time without being released in any way; so that before the other half is out, the first breeze winds up the multiplying wheel till the great knot raises the cylinder, when the mill ceases to act till the small knot releases the gripe as before, and the process is repeated: so that the clock weight is never down, unless, indeed, there should not be any breeze for six weeks after the gripe is released—a case supposed impossible in this climate; and even this might be obviated by doubling the time on the multiplying wheel. The three-wheeled clock, which goes a year on Mr. Harrison Dyer's principle, as reported by Dr. Birkbeck, would be excellently adapted for this business—nothing better; though, for my part, I do not believe a full week has ever passed in England without a light air of some sort. Observe, the non-release of the gripe till required, prevents an impinging force counteracting the effects of the weight: also, the sails of this mill must be either sufficiently flexible to yield to the wind in a storm, or strong enough to resist it; a very small radius is sufficient for this purpose.)

The second method is yet more simple:—To a funnel exposed somewhere on the roof, or where the rain has free access to it, as a rain-gauge underneath, must be hung over a pulley a tilt bucket, to receive the contents of the funnel in rainy weather: this, when full, or to a certain weight, will descend; in doing which, it winds up the same apparatus below, as that before-mentioned by the windmill, with, in one respect, an improvement—for it cannot descend below the place

made for it, or go higher than where it gauges itself, in a simpler manner than in the former case. Thus it ascends and descends as often as the rain admits, *when wanted;* that is, if there is not already six weeks' motion in hand, or already reserved on the multiplying wheel. The ascent is caused by the bucket being emptied when tilted below, and the descent by the rain filling the same when at top, which winds it up; which when done to the fullest time, the bucket ceases to act, and so continues until the multiplying wheel, by its re-action of half the full time elapsed, releasing the gripe, admits, next rain, of its being wound further up. This method is by far the easiest of construction, but I should prefer the former for certainty, as it perhaps might not rain for six months, possibly, though not probably, in England. Yet at the same time the number of powers in the multiplying wheel might be increased accordingly, whereas the quantity of wind necessary in this case would, almost to a certainty, be obtained daily. By a tilt bucket, is to be understood one which empties itself by a pin, placed in any particular part, to tilt it horizontally; or it might be done without tilting, by Mr. Sargeant's method of having a valve in the bottom, and a string to it from above, as described in vol. i. No. 21, page 328, of your Work, or a vertical pin at bottom for the valve to fall on.

Thus, Mr. Editor, perpetual motion might be made, but I have not made it: if you ask why, I answer, because I consider the trouble or inconvenience of winding up my eight-day clock once a week is much less than superadding so much machinery to it, merely for the sake of saying, "*I never wind it up at all.*" Besides, more friction might alter the rate of any clock, therefore I prefer it as it is—the useful to the curious; (as you do, Mr. Editor, I trust, in regard to your Work. You would not, for example, I am sure, give five sovereigns to have a copy of any Number of your Magazine taken to the North Pole by the next expedition under Capt. Parry, and deposited in the hole of the ice which is to receive the flagstaff at that spot, merely to say *your work has extended from south latitude to the North Pole.* No, no; universal benefit and utility to all human beings existing is quite enough for you, and also for your constant admirer,

JOHN BULL.

INQUIRY INTO THE FALL OF THE BRUNSWICK THEATRE.

ADJOURNED INQUEST.

(Continued from page 155.)

March 27.

Mr. John Silvester, engineer, of Bloomsbury, deposed to the conversation between Mr. Whitwell, Mr. Maurice, and Mr. Carruthers, respecting the suspending of weights to the roof. Mr. Whitwell, after the proprietors told him they had a letter from Bristol, authorizing them to hang a steady weight to the roof, appeared still impressed with the danger; and, from his manner, the proprietors ought to have been aware of that impression. This witness (in direct contradiction to the statement of Mr. Carruthers) said—"In that conversation I swear that Mr. Carruthers did *not* require Mr. Whitwell to attend to the strength of the building or the roof."

Mr. Finlay, the scene-painter, gave a most distinct account of the catastrophe. "At the first announcement of danger to the building, on the morning of the accident (which was communicated by a carpenter, running down stairs), I was on the stage. A few minutes before that, I had been in conversation with Mr. Maurice, and also with Mr. Carruthers and Mr. Percy Farren. Jesse Miles, the carpenter (one of the sufferers), was at work on the stage, cutting off a piece of timber. I was standing about the middle of the stage, when I saw the carpenters coming down stairs in a body from their shop. I met them at the bottom of the stairs, and asked them what was the matter? The foremost of them answered, 'We don't like that roof, master—we won't stop there to work any longer—there is something the matter.' I inquired what it was, and he said the mortar was falling, and that there was a cracking noise. My reply was, 'For God's sake, don't run away from danger. If there is any, let us face it'—(considering that if

I allowed the men to go out of the house, an alarm might be created in the neighbourhood to the prejudice of the concern; not supposing the danger was so extensive). I said, at the same time, that there were enough of us to shore it up on one another's shoulders, sooner than we should go and alarm the neighbourhood. The men returned up stairs; and in my eagerness I passed them, and went to my own shop, from which I crossed and went to the carpenter's-shop. Some of the men followed, but the majority of them stopped at the head of the stairs. I had scarcely been in the carpenter's-shop a moment, when I saw the mortar falling from the roof in large lumps. It began slowly at first, but it rapidly increased. By this time I was in the middle of the carpenter's-shop; a cracking of the slates followed, and I jumped down from the carpenter's-shop into my own room. A general rush was made to the stairs by all. I exclaimed at the moment, 'It is all up; but for God's sake don't run down stairs,'—and to prevent that, I jumped off the curb of the stairs a few steps down. In that situation I prevented the men from going down, begging of them to keep close in the angle, as I knew there was an angle-bond or tie there that I thought would protect us. I got as high upon the stairs as I could, for the purpose of taking my hat off the colour-stove. I held it on my head with both my hands, and looked forward down the roof, as far as the shop-floor would allow me. All this was the work of a moment. The cracking and noise of breaking up the slates continued and increased during this interval. I raised my head, and saw the sides of the roof apparently compressed or drawn in towards each other. [The witness here described the effect, as if the legs of a distended compass were drawn in, and bent inwards to each other.] The sides of the roof appeared to collapse, and sink down, and the horizontal ties to be drawn downwards. This tie-beam may be described as the base of a triangle—to it the weights were hung. The tie-beams appeared to be drawn downwards, and at the same moment the ties to the rafters appeared to part from the rafters, and to fall downwards. A shower of mortar and slates followed this, while, at the same moment, from the east or front of the building, the roof appeared to 'claw' off from its situation—or out of the parapet. The roof itself appeared as if drawn from the wall-plate. While we stood in our perilous situation, a shower of bricks and mortar, forming part of the parapet over where we stood, fell over us in such quantity, and with such velocity, that it looked like moving walls before our eyes, and we could see nothing through it. One of the bars of the roof—a hip, I suppose—fell on my shoulder, but slipped down my arm without injuring me. At that moment, one principal cause of dread, the cast iron gutter, weighing several hundreds, fell over our heads, struck the wall, and bounded so as to clear us. When the dust and noise had subsided, myself and the men that were with me found ourselves standing on the stairs, at the level of the painting-shop floor. The men, in a state of great alarm, were for rushing down stairs; but fearful that if all were to go together it might bring down the fragments of the stairs, I persuaded them to go singly. I went first myself, and reached the dressing-room under the stage, followed by the men. Finding that the wreck was so thick there that we had no chance of getting out, we broke a window, through which we escaped. I should say, that on looking from our position on the stairs, one thing struck me as singular: the carpenter's-shop floor seemed to have fallen down in one sheet or body, bearing with it the stage. From the openings, I saw Shaw, the carpenter, with his head much cut. Mr. Richardson, the gas-fitter, and a labourer, rose afterwards. As well as I could observe, the front wall knuckled—part fell inwards, and part outwards." The witness, in cross-examination, stated that he had repeatedly warned the proprietors of the danger to be apprehended from the roof; on which Mr. Maurice sometimes remarked—"We shall see," and the proprietors always cut the conversation short. He admitted that in all theatres the flies were placed, and the shops hung, from the roof, in the same manner as in the Brunswick; but then witness never saw any but a timber roof to a theatre before.

Mr. Stable, the clerk of the peace, proved the granting of the licence, when a pledge was given by the proprietors and Mr. Whitwell, that the theatre should be ready by the 26th of December. The necessary certificate as to its safety was made out, *but no steps were taken* by the magistrates to have the order complied with. Mr. Goff had promised to attend to it.

Shaw re-examined: The whole weight suspended from the roof he calculated at about 24 tons. Mr. Whitwell had never sanctioned it, directly or indirectly.

(*Again adjourned.*)

MISCELLANEOUS NOTICES.

Wool.—So great an effect has the most trifling change of soil or herbage on the growth of wool, that on two farms adjoining each other on the South Downs of Sussex, there is annually a difference in the value of their respective growths of from 3*s*. to 4*s*. per tod, even though the ewes which were shorn should have been originally equally good as to breed and staple. Thin chalky land, covered with fine-textured turf, interspersed with wild thyme, small wild clover, and eye-bright, is that which produces the finest wool. It is, indeed, a well-known fact, that wool always becomes coarse, though increased in weight, from sheep being fed on strong land. Hence it is, that a Southdown ewe produces a fleece full a third heavier, though much coarser, the year she is fattened, than any one that preceded it.

Bituminous Volcano.—The island of Java, which is distinguished by some of the largest volcanoes in the eastern hemisphere, also presents the phenomenon of a volcano of bitumen, or black mud, forming a crater of about sixteen feet in diameter. The tenacity of the bituminous mass is so great, that the gaseous exhalations from beneath drive it up in a conical form from twenty to thirty feet above the surface of the crater, when it explodes with a dull report, scattering a black unctuous fluid, having the odour of naphtha, in all directions. After the interval of a few seconds, the surface of this boiling caldron again becomes covered with a film or crust, and the phenomenon is repeated.

Steelyard.—A new steelyard has been invented in France, which is said to possess greater accuracy than the description of that machine hitherto in use. One of the improvements in the new invention is, the ease with which it can be verified. The divisions, which are marked on the long arm of the beam, begin from a *zero point*; that is, from a point at which the travelling weight places the machine in exact equilibrium, when no weight is attached to the short arm of the beam. This enables the most ignorant persons to judge at once of the correctness of its construction.

Laplace.—Newton doubted whether his theory of gravitation was capable of carrying the weight of this world which he had laid on it. He thought that it would grow old, like human laws, and that a day would come—he has written it—when the hand of the Creator must be extended *to put the system again in order!* Newton was mistaken. No. *To put the system again in order*, there will be no need for the hand of the Creator; it will only require another Newton. M. de Laplace arose, and, by his vast labours, by the power and the resources of his genius, astronomy, reduced to a problem in mechanics, discovered nothing in the obedient heavens but the mathematical accomplishment of invariable laws. Jupiter and his satellites, Saturn, the Moon, are subdued in all their wanderings; what appeared an exception, is the same rule; what seemed disorder, is order more intelligent; above all, the simplicity of the cause triumphs in the infinite complication of effects. In fine,—and this is the summit of the glory of M. de Laplace,—it has been reserved for him to acquit the law of the universe, that is to say, divine wisdom, of this reproach of improvidence or impotence into which the genius of Newton fell; he was the first to demonstrate that the solar system received, in the conditions which were imposed on it, the pledge of its imperturbable duration.—*Royer Collard.*

Adherence to Old Customs.—The Portuguese people manifest an extraordinary spirit of opposition against the introduction of every attempt at innovation; that is to say, against every improved plan of operation, whether in agriculture, mechanics, or any other department of industry. The press now used in preparing oil, differs in nothing from those which were in vogue some centuries back. This rude machine consists of the trunk of a large tree, about thirty feet in length; an enormous stone is the force applied to this clumsy lever, to which it is suspended by a wooden screw, that serves to raise it from the ground as required; and this acts upon the bruised olives, placed near the other extremity of the trunk, and presses the juice from them. A foreigner, residing in Portugal, took the husks and kernels that had passed through this process, and placing them in a press where the power of the screw was properly brought into action, obtained more than an eighth part oil, in addition to what had already been extracted by the common method. The strange antipathy of these people to improvements, may be further illustrated by the following curious instance; the same person, while planting a vineyard, wished to avoid the needless cost and labour attendant on the usual process. According to this, the ground is dug to the depth of nearly four feet, and the vine cuttings laid in at about the same distance apart. The foreigner in question made use of an instrument resembling a large gimblet, which, while it bored the soil, likewise inserted the cutting. It was afterwards discovered, that the native labourers, indignant at the innovation, had, with the young scions, introduced speargrass, which ultimately destroyed them. He also attempted an improvement on the miserable bullock-carts; and succeeded in constructing a cart, which, when heavily laden, was drawn by one bullock, more easily than the awkward machines of the country could be moved by two oxen. But he experienced the greatest difficulty in persuading any Portuguese to work with it; and at length it was intentionally destroyed. One man exclaimed, "I will no longer drive such a cart; for load it 'as heavily as you may, it will not squeak;" alluding to the incessant grating noise produced by their rude revolving axles,—an abominable sound, which the rustics believe to be as encouraging to their oxen as it is agreeable to themselves.—*Historical View of the Revolutions of Portugal.*

Earthquake.—At twenty-one minutes past eight, of the morning of the 23d of February last, the shock of an earthquake was felt simultaneously at Liege, Maestrecht, and Tongres, in the Netherlands, and lasted about ten seconds.

Receipt for Making Coffee.—Buy a Rumford coffee-pot, or biggin, with strainers in it; and if you cannot afford five, six, or seven shillings for this, you must give up the idea of coffee till you can; for it cannot be made either good or cheap without. Your coffee is to be put into the upper strainer, boiling water poured over it, and as soon as it has run through it is ready. If you do this rightly, it ought to be as clear and high coloured as brandy, and of a fine strong flavour; that is, supposing you use a mixture of one half Mocha or Turkey coffee, and one-half Berbice or Bourbon, which is better than either singly. You must not forget, also, to boil the milk (cream if you have it) which you put with your coffee, for *cold* milk or cream will spoil the best coffee ever prepared.

Suspension Bridges.—A new mode of constructing suspension bridges has been recently introduced into Scotland. The chains or rods are placed below, and the weight rests on the rods by means of cast-iron brackets, on which the beams are placed. The rods, which are of chain iron, are bent round the ends of the beam, and fastened with a hoop of iron to prevent springing. Buckling screws are placed on the rods near the brackets, for the purpose of lightening the rods and raising the beams to the level, so that the whole structure can be adjusted with the greatest ease. From the construction, it will be easily seen that

the whole weight or pressure is exerted on the iron rods or wires, in the direction of their length, so that they have no tendency to break or bend in a lateral direction. The amazing strength that this mode of connecting the ends of a wooden beam imparts to it, may be illustrated by a very simple experiment. Let the mechanic take a piece of wood, about two or three feet long, and an inch in diameter; place the ends of it between two chairs or stones, and attempt to stand upon it; and he will find it break almost instantaneously. Let him now take a similar piece of wood, and bend, round the two ends, a piece of wire so much longer than the wood as to allow a small wedge, or wooden pin, two or three inches long, to be placed vertically between the wood and the wire, and he will find that he will be unable to break it, though he leap upon it with all his force. The application of this principle may be seen in all cases where brackets and trussed beams are employed, though it has been seldom, perhaps, carried to the extent which it obviously admits of.—*The Verulam.*

Compulsory Labour.—Our esteemed French correspondent, F., has communicated to us a letter from the celebrated Condorcet to the Secretary of the Academy of Chalons sur Marne, dated 1777, on the subject of Mendicity, in which he takes notice of the sort of punishment mentioned in our 240th No. page 143, as having been practised in Holland, and stigmatizes it as unnecessarily cruel. "I am delighted," he says, "that you have received so many good communications on the important question (Mendicity) which you have proposed. There is a mechanical branch of that question which deserves to be considered separately—I mean the practicability of inventing machines adapted to different trades, by which the blind, persons without hands or legs, &c. might be enabled, without almost any apprenticeship, to gain a subsistence for themselves, or at least some help towards it. Means might also be invented, to make criminals, who are a species of disabled persons, useful. The plan of compelling them to work which is adopted in the Maisons de Force of Holland, seems to me not a little cruel. The culprit is placed in a deep cistern, into which water falls incessantly through a pipe, and he is obliged to work hard, without ceasing, at a pump, to save himself from being drowned. Care, indeed, is taken to proportion the quantity of water and the duration of the labour to the man's strength; but according as he gains strength by the exercise, his task is increased." A more wanton mode of punishment it would certainly be difficult to devise; and in proportion as it has that appearance to the criminal, it must have the effect of irritating and hardening, rather than of subduing and reforming, his mind.

Magnetism.—A Mr. Clarke, lecturing in a small town in the country, on natural philosophy, asserted, that magnets held together by magnetic attraction in the atmosphere, would separate if suspended in the receiver of an air-pump, when the air was exhausted.—Is this true?—F. K.

First Surgical Instruments.—Though iron is said to have been discovered by the burning of Mount Ida, 1432 years before Christ, it was not in general use within this period. Flints, and the bones of beasts and fishes, were probably the first instruments used in the surgical art; limiting the extent of operations, as well as their success and safety. We know that the Egyptian embalmers employed an Ethiopic stone, exceedingly sharp, for opening dead bodies, and taking out the entrails. With such stones, circumcision was also performed, and the history of the most barbarous nations furnishes us with similar practices. We are informed by M. Dymond, who was some time upon the coast of Africa, that the natives are so expert in the use of flints, that they open a vein with nearly as much facility as a European would with a lancet. De la Vega, in his *History de Yncas* (vol. 1. b. 2, ch. 24), mentions the dexterity of the Peruvians in bleeding with sharp flints. The practice of venesection, for the cure of diseases, was not in vogue till after the Trojan war.

Aërolite.—Mr. Prinsep, of Benares, has communicated to the Asiatic Society of Calcutta, an account of an aërolite that fell in the district of Azim Gerh, on the 27th of February, 1827, at about 3 P.M. Four or five fragments of it were picked up three or four miles asunder. One small piece fell on a tree and broke it; another wounded a man severely in the arm: the largest piece weighed three pounds. The surface was black and slaggy, the interior grey, friable, and sparkling, with particles of metallic nickel and iron interspersed. The specific gravity was found to be 3·5. The stone required the aid of oxygen gas to fuse it; and when crumbled, the magnet separated about one-eighth of metallic grains, which left the earthy matrix more fusible; the presence of chrome and nickel were recognized by their respective tests.

NEW PATENTS.

Caleb Hitch, the younger, of Ware, in the county of Hertford, brick-maker, for his having invented or found out an improved wall for building purposes.—21st February—2 months.

George Dickinson, of Buckland-mill, near Dover, in the county of Kent, paper manufacturer, for his invention of an improvement or improvements in making paper by machinery.—21st February—4 months.

Angelo Benedetto Ventura, of Cirencester-place, Fitzroy-square, in the county of Middlesex, professor of music, for his having invented certain improvements on the harp, lute, and Spanish guitar.—21st February—6 months.

Thomas Otway, of the parish of Walsall, in the county of Stafford, iron master, for his new invented expedient for stopping horses when running away with riders or in carriages.—21st February—2 months.

NOTICES TO CORRESPONDENTS.

Subscribers, in possession of incomplete sets, are informed that a small stock of odd Numbers is still on hand, out of which they may probably be supplied with what they want at the original price.

The continuation of the series of papers on Fluxions, New Fire Engine, and farther Correspondence respecting Mr. Child's Inventions for the production of Geometrical Figures by Continuous Motion, in our next.

Communications received from F.—Mr. Baddeley—Mr. Utting—Mr. Peacock—W. B. B.—W. F.—T. M. B.—But a Clown—Mr. Brown—A. R.—A Subscriber at Rochester—Eliab—W. W. W.—Exon.

ERRATA.—In the notice in our last, of the Diorama, line 13, for "superior" read "inferior." Page 156, first column, 8th line from the bottom, for "Repository of Arts" read "Repertory of Arts." Same page, second column, 22d line from top, for "half-burnt cock" read "half-burnt cork."

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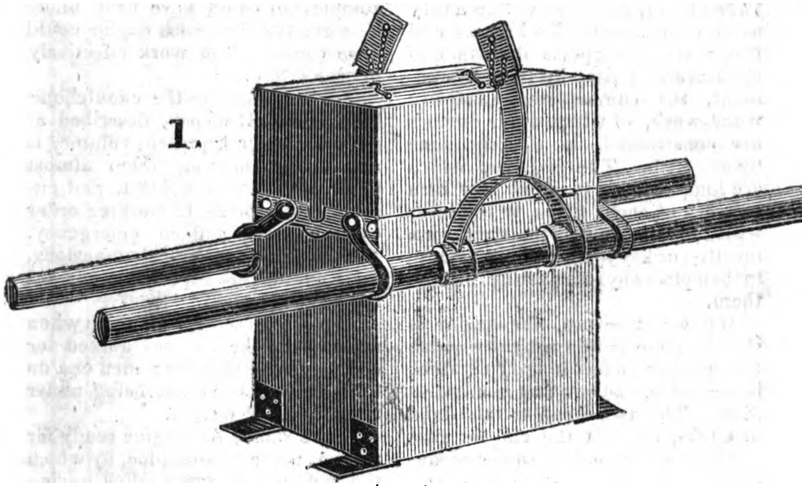
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 243.] SATURDAY, APRIL 12, 1828. [Price 3*d*.

NEW AND COMPACT FIRE-ENGINE.

1.



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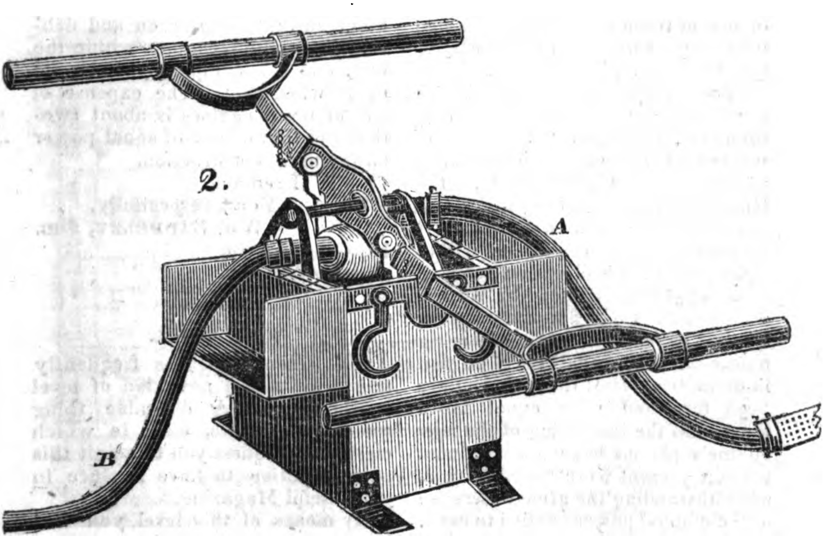


NEW AND COMPACT FIRE-ENGINE.

Sir,—The preceding is a correct representation of a new fire-engine, designed by Capt. Wm. Fisher, R. N., and constructed by Messrs. Pontifex, Sons, and Wood, Shoe-lane.

This engine consists of two working cylinders, with an air vessel between them, arranged within a very small compass, and fixed on a metal frame, which supports the whole of the working parts: by this arrangement, the cumbersome, unsteady wood-work, of which other engines are constructed, is entirely done away with. The handles, which are long enough to allow four men to work at each, fit on to the lever which carries the piston rods, by a mortise, or key joint, and are secured in their places by pins passing through them.

When not in use, the engine is shut up close within a light wooden box, about two feet long by eighteen inches wide, and two feet four inches high. The two handles take hold of hooks, fixed at the end for that purpose, and thus furnish the means of removing it from place to place.

I had the pleasure of being present, a short time since, at the trial of one of these engines (constructed for the Sybil frigate) at His Majesty's Depôt, in Tooley-street.

Worked by eight men, and with a nose-pipe 9-16ths of an inch in diameter, it delivered a stream of water on the top of those very lofty warehouses. Unfortunately, the leathering of one of the pistons was imperfect: as it was, however, it delivered a stream of water within a *few feet* of the elevation reached by an engine constructed by Messrs. Tilley and Co., Blackfriars-road, worked by *fourteen* men, and having a nose-pipe of only 8-16ths of an inch in diameter. Had the two engines been furnished with equal nose-pipes, and the leathering of the new engine's pistons been perfect, most persons present were satisfied that, notwithstanding the great difference in the manual power applied to each, the new engine would have had a most decided advantage. I may here observe, that the men who worked the engine of Messrs. Tilley and Co. appeared not to have so much to do as they were capable of, and could, perhaps, have continued at work longer than those with the new engine. Had the latter engine, however, been allowed fourteen men, eight working at once, and relieving each other as they became tired, no comparison could have been made between the time each engine could have continued to work effectively in case of fire.

To these engines the caoutchouc hose of Mr. Hancock, described at page 108 of your present volume, is attached,—rendering them almost proof against any neglect, and ensuring their being in working order on the most sudden emergency. For ships, or gentlemen's mansions, these engines are superior to any yet before the public.

Fig. 1 represents this engine when not in use; the handles affixed for carrying it, which four men can do with ease, the weight being under three hundred weight.

Fig. 2 shows the engine ready for use. A, is the suction pipe, by which this engine is always supplied, having no cistern of its own to work from. B is the delivery hose. It will be observed that the suction and delivery pipes both terminate within the box, and are completely enveloped by it when shut. The expense of one of these engines is about two-thirds of that of one of equal power on the usual construction.

I remain,

Yours respectfully,

Wm. Baddeley, Jun.

10, *George-yard,*
Lombard-street.

NEW LEVEL.

Mr. Editor,—It has frequently struck me that a new kind of level would be a very desirable thing among mechanics, &c.; to which end I now request you to admit this new invention to have a place in your useful Magazine.

By means of this level you will be able to ascertain what angle any surface which is not horizontal makes

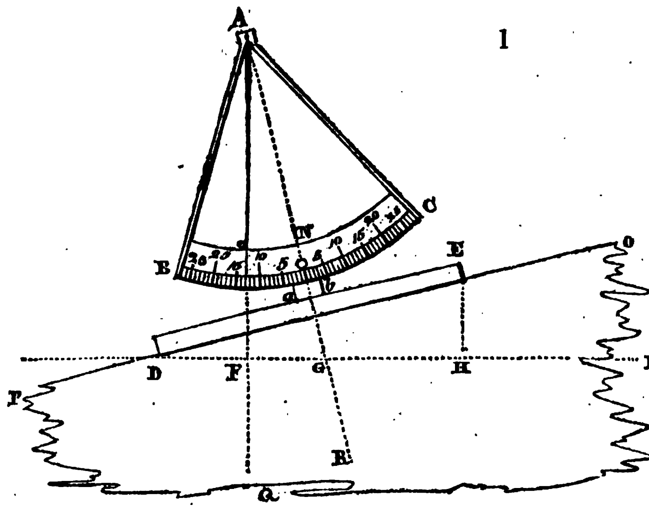
with the horizon; and by referring to the Table below, how many inches, and decimals of an inch, the lower end must be raised, or *vice versâ*, in order that the surface may be horizontal.

Value of Sines of Arcs, expressed arithmetically.

Sines of	Rad. =1.	Rad. =4.	Sines of	Rad. =1.	Rad. =4.	Sines of	Rad. =1.	Rad. =4.	Sines of	Rad. =1.	Rad. =4.
1° 0′	·017	·068	6° 50′	·119	·476	12° 40′	·219	·876	18° 30′	·317	1·268
10′	·020	·080	7° 0′	·121	·484	50′	·222	·888	40′	·320	1·280
20′	·023	·092	10′	·124	·496	13° 0′	·224	·896	50′	·322	1·288
30′	·026	·104	20′	·127	·508	10′	·227	·908	19° 0′	·325	1·300
40′	·029	·116	30′	·130	·520	20′	·230	·920	10′	·328	1·312
50′	·031	·124	40′	·133	·532	30′	·233	·932	20′	·331	1·324
2° 0′	·034	·136	50′	·136	·544	40′	·236	·944	30′	·334	1·336
10′	·037	·148	8° 0′	·139	·556	50′	·238	·952	40′	·336	1·344
20′	·040	·160	10′	·142	·568	14° 0′	·241	·964	50′	·339	1·356
30′	·043	·172	20′	·144	·576	10′	·244	·976	20° 0′	·342	1·368
40′	·046	·184	30′	·147	·588	20′	·247	·988	10′	·344	1·376
50′	·049	·196	40′	·150	·600	30′	·250	1·000	20′	·347	1·388
3° 0′	·052	·208	50′	·153	·612	40′	·253	1·012	30′	·350	1·400
10′	·055	·220	9° 0′	·156	·624	50′	·256	1·024	40′	·352	1·408
20′	·058	·232	10′	·159	·636	15° 0′	·258	1·032	50′	·355	1·420
30′	·061	·244	20′	·162	·648	10′	·261	1·044	21° 0′	·358	1·432
40′	·063	·252	30′	·165	·660	20′	·264	1·056	10′	·361	1·444
50′	·066	·264	40′	·167	·668	30′	·267	1·068	20′	·363	1·452
4° 0′	·069	·276	50′	·170	·680	40′	·270	1·080	30′	·366	1·464
10′	·072	·288	10° 0′	·173	·692	50′	·272	1·088	40′	·369	1·476
20′	·075	·300	10′	·176	·704	16° 0′	·275	1·100	50′	·371	1·484
30′	·078	·312	20′	·179	·716	10′	·278	1·112	22° 0′	·374	1·496
40′	·081	·324	30′	·182	·728	20′	·281	1·124	10′	·377	1·508
50′	·084	·336	40′	·185	·740	30′	·284	1·136	20′	·380	1·520
5° 0′	·087	·348	50′	·187	·748	40′	·286	1·144	30′	·382	1·528
10′	·090	·360	11° 0′	·190	·760	50′	·289	1·156	40′	·385	1·540
20′	·092	·368	10′	·193	·772	17° 0′	·292	1·168	50′	·388	1·552
30′	·095	·380	20′	·196	·784	10′	·295	1·180	23° 0′	·390	1·560
40′	·098	·392	30′	·193	·796	20′	·298	1·192	10′	·393	1·572
50′	·101	·404	40′	·202	·808	30′	·300	1·200	20′	·396	1·584
6° 0′	·104	·416	50′	·205	·820	40′	·303	1·212	30′	·398	1·592
10′	·107	·428	12° 0′	·207	·828	50′	·306	1·224	40′	·401	1·604
20′	·110	·440	10′	·210	·840	18° 0′	·309	1·236	50′	·404	1·616
30′	·113	·452	20′	·213	·852	10′	·311	1·244	24° 0′	·406	1·624
40′	·116	·464	30′	·216	·864	20′	·314	1·256			

I will now proceed to explain the instrument.

D E (see fig. 1, next page), is a piece of hard wood, or brass, half an inch thick and four inches square. A B N C is an arc of 60° made of brass, having its radius N A equal to four inches; at N (the middle point) a scratch and zero are engraved; this arc having a small neck *a b*, fixed perpendicularly in centre point of square base



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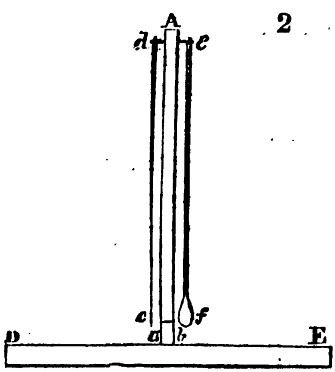


2

D E. At the point A is a narrow notch; and by it are supported (seen sideways in fig. 2) an index *c d* and a rod of same length, with an ounce weight fastened to the end; the index and rod are fastened together by a thin round piece of steel wire, which works in the notch above described. Now the weight *f* will cause *e f*, and consequently *c d*, always to be perpendicular to the horizon; wherefore, if (fig. 1) B C be graduated, *c d* will point out the number of degrees contained by angle N A C.

Let P O Q be a block of wood, or any other substance: we wish to discover what angle its upper surface P O makes with the horizon. A *c* is always perpendicular. Produce it by the dotted line c F. Draw the line A N G, and produce it to R. Through D draw D M parallel to horizon. Draw E H perpendicular to D M. Now, A F G, G L E, E H G, are right angles; and since interior angles of a triangle=four right angles, and G C E+G H E= two right angles ∴ L G H+L E H =two right angles; but L G H+H G R=two right angles ∴ L G H+L E H=L G H+H G R ∴ L E H= H G R: but the alternate angle H G R=L G F ∴ L E H=L G F and the angles A F G, D E H are right angles ∴ remaining angle F A G=remaining angle E D H. Now, E H=sin. E D H=sin. F A G. Hence, if angle F A G (or G A N) be determined, E H may be obtained in inches and decimal parts of an inch, in the Table.

Wherefore, the rule by which this instrument is to be used is, "Ascertain what degree *c d* points to, look for the value of those degrees in the third column of table; this will give now the length of E H, the height to which D must be raised, or E lowered, in order to make P O parallel to horizon."

I have, in the above table, given three columns; the first consists of arcs from 1° to 24°, with every 10th

minute; the second shows the value of the sines of those arcs when radius $=1$; and the third column contains the value of sines of those arcs, in terms of radius$=4$, because I have made the base D E of the instrument four inches. Should it be required to make the base larger, 5, 6, &c. inches, then a new third column must be made, by multiplying the second column by 5, 6, &c. whichever the length of the base is.

By the plumb-line you are not enabled accurately to ascertain how many degrees the surface to be examined is defective; neither are you able to do so with the level used in telescopes.

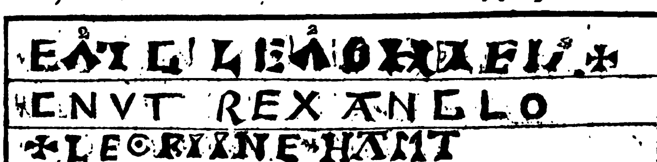
This instrument may be otherwise used. If it be required to erect an inclined plane of any particular angle, or to ascertain how much an inclined plane already erected slopes.

I am, Sir,
Yours, &c.
N. V. T.

January 22, 1828.

COIN FOUND AT ST. CATHERINE'S DOCK.

Sir,—After what has been said by "T. W. P." and "Δ," on the above subject, and after the certainty that the reverse of the coin reads LEOFWINE HAMT has been ascertained, I should coincide with the opinion of "T. W. P." and "Δ," could I, by twisting and torturing the inscription in any way whatsoever, contrive to extort the four letters CNVT from it. I have placed "T. W. P.'s" reading under a fac-simile of the inscription, that the reader may judge for himself.



However, on looking closely into the inscription, I think the first three letters may be an abbreviation of CNVT, the middle letter N being a contraction of NV and part of the T; such contractions frequently occur in Anglo-Saxon coins. But what can be made of the remainder of the inscription, any person may judge as well from the above fac-simile as from the coin itself; and I would appeal to the most inveterate etymologist, if the legend can be read REX ANGLO. The letters marked 2 2 are decidedly the same; and as the letters on the reverse are determined, I have copied them also, to enable the reader to judge better.

I am unable to obtain any information in the way proposed by "Δ," for reasons which it is not necessary to mention.

I am, Sir,
Yours, &c.
JOSEPH BROWN.

Cannon-street.

GLASS'S IMPROVED APPARATUS FOR SWEEPING CHIMNEYS.

The obstinacy of the multitude in adhering to old usages, even when the strongest considerations of justice and humanity call for their abolition, has been shown, perhaps, in nothing more than in the slow progress which has been hitherto made by that most praiseworthy association, "The Society for superseding the necessity of Climbing Boys in Cleaning Chimneys." For ten years and more have they been incessantly pressing on the attention of the people of this Christian country the shocking and culpable cruelty of employing infants (for such in truth they are) in an occupation invariably attended with great bodily suffering and laceration—always ruinous to the health and morals of its poor victims, and often fatal to life itself. Example after example have they adduced in proof of its inhuman character,—children (even

female children!) of the tender age of six, seven, and eight, compelled, by driving pins and forks up the soles of their feet, and burning straw and powder under them, to force their way up flues too narrow even for their diminutive frames,—children dislocated in every limb, through being dragged down, by means of ropes, from chimneys in which they had stuck fast,—children dug out, dead and dying, from the sides of chimneys, when ropes had proved unavailing,—children actually suffocated and burnt to death! And over and over have the Society shown, that not in one case out of a hundred, in which children are subjected to such horrible chances as these, is there any occasion to employ children at all; but that, on the contrary, mechanical means may, in *most* cases, be substituted with advantage; and in *all*, at no greater sacrifice than a *very little additional trouble and expense*. Yet, to the shame of the British public,—to its especial shame, as beyond all others ostentatious of its sympathy for human suffering,—be it told, that not in one case out of a hundred have mechanical means been as yet substituted for that atrocious practice, which has for its inseparable characteristics—infant misery and infant destruction! The Committee of the House of Commons, which was some years ago appointed to examine this subject, showed a perfect acquaintance with the little dependance which is to be placed on the mere operation of humane feelings on the mass of society, when usage and convenience stand in the way, by stating it as their opinion, that no *regulations* whatever would obviate the miseries complained of, and that the only way to put an end to these miseries was to PROHIBIT THE USE OF CLIMBING BOYS ALTOGETHER. Neither do we believe that, till this is done, any considerable diminution will ever take place in the practice. Make this sort of *infant sacrifice* as much a felony as that of kidnapping and selling men to slavery, and hold all concerned in it, whether as masters or employers, equally guilty; and then, and not till then, we may expect to see it universally abandoned. The very omission or delay of the legislature to pass a statute to this effect operates as a direct sanction of the usage, from the habit so natural to the people of this law-ridden country, of concluding that there can be nothing particularly atrocious in any action which is not prohibited and punished by law. And why, may we ask, has the recommendation of the Committee of the House of Commons, to pass such a law, not been carried into effect? It is stated in a pamphlet, circulated by the Society, that a "Bill for the Abolition passed almost without opposition through one House (the House of Commons), and would, in all probability, have passed through the other, had not objections, *unconnected with the real merits of the case*, been raised to it." We do not at present remember exactly what the circumstances which led to the rejection of the Bill were; but if they were, as here stated, "unconnected with the real merits of the case," why has not a new Bill been brought in? Is it not rather the fact, that the Bill was rejected because, in the opinion of certain noble lords, it was not clearly made out in evidence that all chimneys, without exception, could be cleaned without climbing boys? And was not the practice defended on the same abominable principle that the African Slave Trade, now so happily abolished, used to be defended; namely, that it is no matter what may be the miseries we inflict on others, if we cannot go on conveniently without inflicting them? We may possibly be mistaken, but we have a strong impression on our minds, that such was nearly the real state of the case; and that the delay in bringing in a new Bill for prohibiting the use of Climbing Boys has arisen solely from a conviction entertained by the benevolent individuals who have associated for the purpose of effecting this important object, that it was of no use to repeat the attempt, till the mechanical means of sweeping chimneys were brought to such perfection, and such

a body of evidence collected of the invariable efficiency of these means, as would silence every possible opposition to the claims of humanity.

Whether right or wrong in these conjectures, we have great pleasure in being now able to congratulate the Society on the production, under their auspices, of an improved plan, so perfectly applicable to all cases (to cases even where boys cannot be employed), as to leave both Parliament and individuals without the slightest apology for abetting any longer the horrid cruelties of the climbing-boy system.

The plan is an improvement, by a Mr. Joseph Glass, of an apparatus originally invented by Mr. Smart. The Committee of the Society state, in a circular to the public, that Mr. Glass "has not only swept eight hundred and twenty-three flues, during the year 1827, without meeting with more than *thirteen* cases in which he did not succeed (and in these the difficulty might have been overcome, had the parties consented to a little alteration at a very trifling expense); but he has even swept flues which boys could not ascend." On the two next pages are engravings of Mr. Glass's apparatus, and the following is the description of them given by the Society:—

"The brush, of which fig. 1 is a section, is made of a round stock *a*, commonly alder, and pierced with small holes, into which bunches, formed of strips of the best whalebone, are inserted, and made fast by glue. These strips *b* are 8 to 8½ inches in length; which renders the brush, including the stock, about 20 inches in diameter. It therefore completely fills, and consequently effectually cleanses, the largest flues, which are never more than 14 inches square, and seldom more than 14 inches by 9. To make it pass more readily up the chimney, a small wheel *f* is fixed to the top of the stock *a*. At the end of the stock *c* is a very strong brass ferrule with a wormed socket, which receives the screw of the first joint *d*.

"Fig. 2 is a representation, in their actual size, of the ferrules. The three first portions, *a d d*, 2½ feet in length, are made of good cane; the rest, *e e e*, &c. of ground-ash, and of the same length; the number used depending, of course, upon the height of the chimney: these gradually become stronger towards the bottom, and are affixed to each other, as the brush is forced higher up the chimney, by means of the brass screws and sockets, fig. 2, before described.

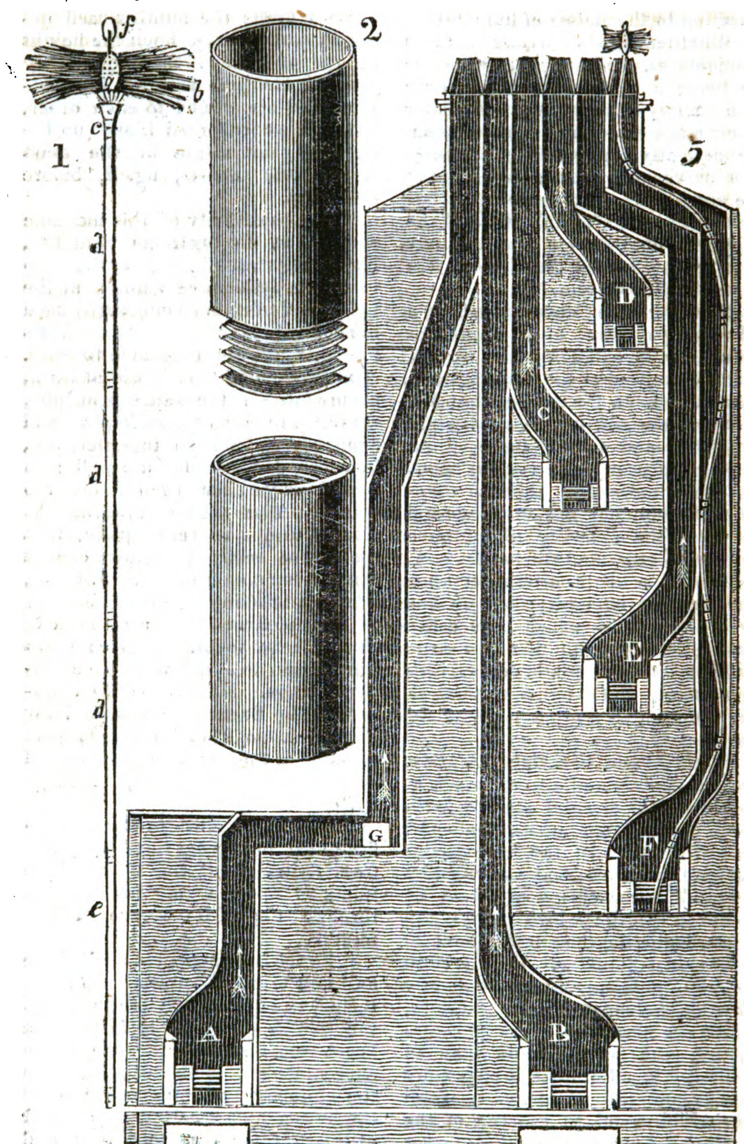
"The superiority of this machine consists in its extreme pliability, lightness, strength, and aptitude to turn by a little force applied at the bottom. It has been effectually used in crooked chimneys, where Smart's machine has not been able to pass. A machine has been made at Bath, somewhat on the same principle; the joints or portions, made of several slight canes twisted together, are, however, fastened by a small iron screw, which has been found too weak. The whole machine is clumsy, and is so very pliable, that the force exerted below cannot drive it up the chimney. J. Glass, who is a bricklayer, a manufacturer of his machines, and a cleanser of chimneys by them, has given great satisfaction to those who have employed him. He sweeps the chimneys of the Excise, the King's New Palace, Lloyd's Coffee-house, part of those of Somerset House, and of several insurance offices, banking-houses, &c. *

"Fig. 3 is a cloth to fix over the fire-place, to prevent the falling soot from flying about the room. The joints of the machine are worked through the little sleeve in the middle.

"Fig. 4 is an apparatus called the ball and brush. An iron ball is attached to one end of a long rope, in the middle of which is fastened a brush very similar to the one in the cane machine. The ball is let down the chimney by a man at the top of the house, and received by another at the bottom: they work it up and

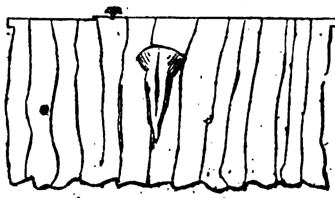
"* He resides at No. 2, Moor-lane, Fore-street, Cripplegate, and duly attends to orders, by the Twopenny Post, from any part of the town.

down, till the chimney is thoroughly cleansed. This apparatus is only used in very crooked flues which have no part quite horizontal. It is now nearly superseded by the introduction of the cane machine.



"Fig. 5 is the end of a house, showing the sections of flues in the different stories, as they are occasionally formed. A is a flue with a horizontal part, which rarely occurs, but which can only be adapted

to a machine by the insertion of a small iron door at G, or by the removal of two bricks at that corner, when it is swept; either of



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which may be done at a trifling expense. The machine then works from G to the top, from G to the opposite corner of the horizontal part, and from the fire-place to the same. These are the flues which are very dangerous to the boys, and which are never well swept by *them*, unless there is an opening at G; for when a boy has swept all the upper part, there must be a great collection of soot at G; through which, when he descends, he is obliged to work his way by main force, at the imminent hazard of being suffocated. The quantity of soot that he can force along a horizontal part, 30, 40, and even 60 feet long, and which is so small as not to admit of his turning himself round, must be very little indeed, in comparison to the quantity obtained from the perpendicular part.

"B, C, and D are flues of the common form, as they exist in ninety-five cases out of a hundred.

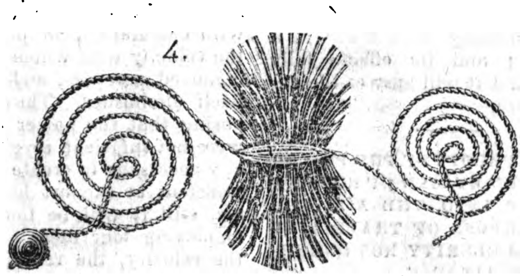
"E and F are crooked flues, which have hitherto been cleansed by the ball and brush, but which may now be done by the cane machine which is represented in *f*. It is very desirable, however, that such flues should never be built.

"The cane machine is recommended on account of its extreme pliability, and as being more durable; and though at first the most expensive, it will eventually be found to be the cheapest."

We subjoin a very useful and necessary caution promulgated by the Society.

"It is of great importance to the cause of humanity, that where machines are introduced, if they do not fully answer the purpose, it should be ascertained whether the person who undertakes to sweep chimneys with them understands how to use them properly, and is disposed to do full justice to this substitute for climbing-boys. In many cases, the masters have been so long accustomed to indolent habits, that they are very averse to any plan which shall require them to work, rather than continue to employ those who are obliged to submit to the severest sufferings without exciting one sympathetic emotion in the hardened hearts of their masters."

4.

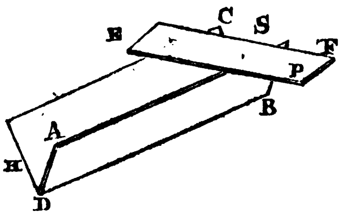


NEW AND USEFUL ASTRONOMICAL INSTRUMENT;

INVENTED BY MR. SHIRES, MATHEMATICAL TUTOR.

"Let A B, C D, and E F, (see fig. next page) be three plane mirrors, viewed by the eye at S; so that while the reflection of the sun, or moon, &c. appears to move along the edge from P to E, the reflection from the inclined planes A B and H C will appear to move

the contrary way. Now, if angle A D H be 90°, the reflection will cross but once per day; but if the angle is acute, it will cross twice



per day: so if the angle betwixt the lines of crossing be correctly determined, and compared with the corresponding time per watch, it will, in some cases, be found correct enough to determine diurnal parallax to a greater certainty than can be done with any instrument now in use. The frame work to this transit will be easily judged of by the workman, and its adjustment from experience. It is, therefore, only necessary to say, that D B must be in the meridian (or nearly so), and the end B risen as the declination may require; though not forgetting that the time with declination varies directly as the radius, and inversely as the cosine of that declination.

Note.—The instrument will most probably be made by Messrs. Watkins and Hill, 5, Charing-cross, London.

It has already been made in a rude state; and its effects fully establish that it will answer the desired purpose.

FURTHER PROOFS OF THE POWER POSSESSED BY MAN OF RAISING HIMSELF INTO THE AIR, FOR THE PURPOSE OF TRAVELLING WITH A CELERITY NOT OTHERWISE ATTAINABLE.

In my last communication, it was stated to have been ascertained by experiment, that a surface of one foot square, moving at the rate of 100 feet per second, would sustain a weight of 15 lbs. in the air. I shall now, in the first place, attempt to show that a still greater weight is given by calculation. If a surface be moved perpendicularly downwards, with a velocity of 100 feet, the resistance to its motion, measured in weight, will be equal to the weight of the number of cubic feet of air successively displaced, multiplied by the velocity with which it is displaced: in other words, the resisting effort of the air, opposed to a square foot moving with 100 feet velocity in a second, will be equal to the weight of 100 cubic feet of air multiplied by the velocity with which the surface moves;—taking, therefore, the weight of a cubic foot of air at *one ounce*, the resisting effort *r* will be equal to 100 ounces × 100 = 625 lbs. Now, if we call the weight sustained by this resisting effort *x*, the value, or momentum, or effect, of this weight, for the second during which the surface moves through 100 feet to produce the equilibrium, will be equal to *x* multiplied by 32, the velocity obtained by this weight after falling through six feet during the second in question. We have, therefore, *r* into 625, equal to *x* into 32. *x* thus equals 625 divided by 32, or 19 lbs. 8 oz. It appears, therefore, that *the calculation* above stated gives a greater result than the experiment; owing, no doubt, to the yielding nature of the medium against which the surface acts. It should also be observed, that the result will coincide more nearly with calculation, in proportion as the velocity with which the surface is moved increases, and the surface itself diminishes. Thus, even supposing that the power of one man were not sufficient to give the velocity necessary to create a resistance sufficient to support himself in the air, still it will be found, that by employing four men, and doubling the velocity, the resistance will be quadrupled; and hence, by increasing the power employed, there can be no doubt of obtaining a sufficient resistance.

The power of four men, acting on a non-yielding medium, would raise 2,400 lbs. through ten feet per minute. Supposing, therefore, the weight of these four men to be 600 lbs., and the weight of machinery

necessary to carry them, 300 lbs., then would these men have an excess of power equal to 1,500 lbs. more than necessary to raise themselves and the machine: that is to say, if there were a loss of one half of the power of the men, arising from the impulse being given through a yielding medium, four men would still have power sufficient to raise themselves into the air, with a very considerable portion in store for progressive motion and other purposes, namely, 300 lbs., whereas, if only one man were employed, supposing his weight to be 150 lbs., the machine 200 lbs., he would not have sufficient power to raise himself, if there were a loss of one half his power from the yielding nature of the medium; not only, then, may the resistance be brought to the calculated result above stated, of about 20 lbs. to the square foot, by increasing the magnitude and power of the machine, but the weight and other drawbacks, whether human or other elementary force be employed, will be diminished as the velocity is increased.

I conceive, therefore, there can be no doubt that man possesses the power, if not individually, *by combination*, of navigating the air to any extent; and, indeed, when we recollect the effects we must all of us have witnessed, in a greater or less degree, of houses and trees torn up by the wind, the greatest velocity of which seldom exceeds 90 feet per second, we cannot, for a moment, doubt the production of equivalent effects by producing similar relative motions between the air and such implements as we may employ for that purpose; the great difficulty is that of producing sufficient velocity, which is now overcome by the rotary propellers.

W. C.

ASTRONOMICAL QUERY.

Sir,—Allow me to make a few remarks on the last communication of your correspondent "*Vectis*," (vol. ix. p. 150), where he observes that my letter (vol. viii. p. 224) conveys an idea, that when the differences of longitude are stated in time, *mean* solar time is to be understood, and no other. Now, Sir, I contend that what I said does not convey a false impression; and that *mean* solar time is to be converted into longitude generally, unless it be expressly stated to the contrary.

Your correspondent also further states, that he wishes to be understood as stating a *positive* and *incontrovertible* fact,—that when the differences of longitude are expressed in time, such time may be *indiscriminately* considered as *mean solar*, *sidereal*, or *apparent*, and reduced to equatorial arcs at the rate of 15° to one hour.

Now, Sir, when the sun transits the meridian of two places on the earth's surface, differing in longitude, the difference of longitude between the two stations cannot be correctly ascertained from the *apparent* times at the respective stations at which the transits are observed, as the error will be proportional to the *variation* of the equation of time during the interval of the observations.

The length of the *apparent* day is continually varying. At about the 21st of December, there is 30 seconds difference in time between two consecutive returns, or transits, of the sun over the same meridian, which amounts to 1-2880th part of the whole; and unless 24 hours minus 30 seconds were divided into twenty-four equal portions of time, the allowing of 15° of longitude for one hour must be erroneous, as our clocks are not intended to measure *apparent* but *mean* solar time; otherwise the rate of the clocks must be continually varying: in fact, no clock is constructed to show *apparent* time; hence your correspondent's misconception of the problem is manifest.

Clocks constructed for astronomical observatories are adapted to measure *sidereal time*, *i. e.* the period of time elapsed between two consecutive returns of a fixed star to any given meridian. This interval of time is divided into 24 equal parts, or sidereal hours, which are reckoned from 0 up to 24, instead of two periods of 12 hours each.

Consequently, if a fixed star transit the meridian of two different places, and the interval of time elapsed between the transits be converted into degrees at the rate of 15° to 1 hour, the difference of longitude between the two given stations will be correctly ascertained.

But chronometers and clocks in general use are adapted to *mean solar time;* the result will, therefore, in this, as in the latter case, be precisely the same—the time in both cases being *equable.*

Not so for apparent time. Although *apparent* time is used for finding the difference of longitude on the earth's surface, it should, notwithstanding, be corrected for the meridian of each of the given places, by applying the equation of time for the precise instant when each respective observation was made. This process converts the *apparent* into *mean* time; which is necessary when time-keepers are employed, and which method was, I presume, adapted by *Dr. Brinkley;* otherwise, had he made his observations about the 21st of December, he would have involved an error of nearly eight seconds in the difference of longitude between Greenwich and Dublin.

Apparent noon, as given in the "Nautical Almanac," is the instant of time when the sun transits the meridian of Greenwich, and which, on the 21st of December, takes place before noon, as denoted by mean time, or by our best time-keepers, which keep true time; and as the equation of time is subtracted from *apparent,* to obtain *mean* solar time, the relation of the latter to the former will stand as follows: viz.

	hrs.	*m.*	*s.*	
Dec. 21. *Apparent* noon	24	0	0	
Equation of time..	0	1	43·6	
Mean time	23	58	16·4	$=a$
Dec. 22. *Apparent* noon	24	0	0	
Equation of time..	0	1	13·6	
Mean time	23	58	46·4	$=b$
Whence $b-a=$	0	0	30	
∴ The *apparent* day is =	24	0	30	
of *mean* solar time.				

Consequently, if 15° are allowed for 1 hour of *apparent* time the result must evidently be incorrect by 1¼ seconds for every degree of longitude east or west of Greenwich!!

It is, however, distinctly stated in the "Nautical Almanac," that when time-keepers are used, the *apparent* time deduced from an altitude of the sun, must be corrected by the *equation of time,* and the *mean time* found, compared by the watch; the difference will be the *longitude* in time from the meridian by which the watch was set. I have not seen *Dr. Brinkley's* computations; but he, no doubt, used *apparent* time; as the longitudes, right ascensions, &c., in the "Nautical Almanac," are computed for *apparent* time for the meridian of Greenwich: and as his is a fixed observatory, there is also little doubt but he employed a time-keeper in finding the difference of the meridians of Greenwich and Dublin. In which case, there is no doubt but he reduced the *apparent* to *mean* time, unless there happened to be but little variation in the equation of time when his observations were made.

In fact, the time employed, of whatever denomination it may be, must, it is evident, be equable. It matters not whether the earth revolve on its axis in 24 hours, or in 10 hours as in the new French system, or whether the rotation of the earth be referred to the fixed stars, sun, or moon; provided the same aliquot part of a revolution of the earth on its axis correspond to a similar aliquot part of its circumference in each case respectively.

Further remarks might have been made on the last communications of your correspondent; but I trust the above are sufficient to convince the readers of the "Mechanics' Magazine" that I have not advanced any thing hypothetical, or that conveys a false impression, as your correspondent represents.

ASTRO SOLIS.

April 1, 1828.

LAW OF FALLING BODIES.

Sir,—I shall not take up much of your valuable columns in replying to

Mr. Henry Ottley's last letter in answer to mine on the practical application of the laws of falling bodies. Mr. O. has been singularly unfortunate in his last lucubrations; for he is not bold enough to assert that Dr. Hutton's experimental equations are false, nor does he venture to say that I have fallen into any error in the humble task I had to perform, of calculating how far a cast iron ball, weighing 1 1-20 lbs. would descend in the first second, &c. (No. 229, page 404). He gives an equation from Dr. Wood's "Mechanics," viz. $S=m\ T^2$; and then informs us that this equation exactly agrees with *his* rule or equation, which is, $h=x\ T^2$. I certainly must confess they are identical.* But it is not on these theoretical equations that Mr. H. O. and I disagree; it is on their practical application. Dr. Wood, and every other writer on this subject, informs us that the theoretical equations on the laws of falling bodies suppose the motion to be performed in a non-resisting medium. Let Mr. Henry Ottley read what Dr. Wood says in the "Scholium," after the 87th proposition. He states, "That the resistance of the air does not materially affect the motion of heavy bodies when moving with small velocities. In other cases, however, this resistance is so great, as to render the *conclusions drawn from theory almost entirely inapplicable in practice*," &c. But Mr. H. O. would endeavour to force us to believe that from *his equation*, $h=x\ T^2$, the value of h may be found, whether the body be moving in a resisting or a non-resisting medium !!! (See pages 186 and 188, No. 215.)

Mr. H. O. then goes on to inform us, that a guinea and a feather fall, in a vessel voided of air, through the same space in a second, &c. and this he concludes with Q. E. D. Well, if every thing written and ending with Q. E. D. must be understood to be a demonstration, so must Mr. Henry Ottley's; although I think P. N. (papers news) would have fitted better. In his second cor. (which he also adorns with a Q. E. D.), he tells us that the New Light System of the laws of falling bodies does not fall to the ground. Well, as we have sufficiently proved that the N. L. System is not founded upon absolute wisdom, not being in accordance with the laws of nature; perhaps, in opposition to the laws of gravitation, the N. L. System may have found its way to the moon.

I am, Sir,

Yours with respect,

G. S.

* How Mr. H. O. comes to father this equation upon himself, I am at a loss to know; I was always taught to believe that the equations $S=m\ T^2$ or $h=x\ T^2$, and all others on the same subject, were first discovered by that truly great, but ill-requited and persecuted philosopher, Galileo. If I have been misled, I must, of course, infer, that Galileo must have been the pupil of Mr. Henry Ottley. P***s.

CULTURE OF BEES.

Sir,—It is a well known fact, that in many parts of the kingdom bee-hives are appended to every cottage, and are a source of considerable profit to the owner. If the cottagers are suffered to continue the plan they have hitherto practised, of preserving their bees in the common hive, never suffering them to remain longer than three years, and at the end of that period destroying the bees with sulphur, and taking the honey, they will continue to be successful; but if they should, by reading a letter which I saw some time ago in your work, from Mr. J. Cox, of Hackney, be led to the adoption of another plan, their failure will be as complete as their success has hitherto been.

Your correspondent recommends *driving* bees, and thinks that the bees will be enabled to collect honey sufficient for their use during winter notwithstanding. This, Sir, is a palpable mistake; and I think such an opinion is the result of inexperience. He mentions the practice as having been adopted in the south of Europe; but this is the worst argument he could have used, as the reverse of the reason, which he

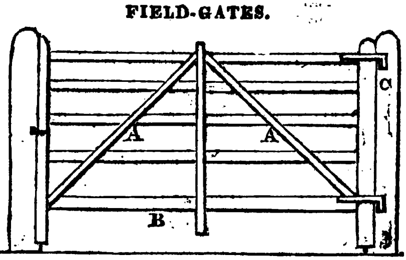
uses to show that such a plan is adopted with success on the continent, militates decidedly against its adoption here. The summers in the South of France, and other parts of Southern Europe, are less variable than in our climate, and of longer continuance. In such countries the plan of driving bees may be adopted with success; but in this country, owing to the reason already stated, failure would be, in almost every instance, certain and complete. Besides, the period at which the driving should take place (about Midsummer), is the time when the comb is occupied with eggs;—chrysalis, and young bees just emerging from the chrysalis, are all in progress;—of course such a violent act as that of driving the bees from the hive, and placing them in an empty one, would at once put a stop to their proceedings.

The object of J. Cox is to obtain a larger quantity of honey than is produced by the common method, while the reverse of this would be the case.

The bees, as I have before stated, must not be driven later than Midsummer: if they are driven later, they will have no chance at all of providing food, but must perish. We will suppose this plan to be adopted in the way your correspondent suggests,—the bees are driven into the empty hive, and placed on their stand,—What do we find on examining the full hive?—A large quantity of comb filled with chrysalis, ready to emerge from the cell, and a small quantity of comb containing honey for the subsistence of the young bees before they are able to leave the hive. We throw aside the comb containing the chrysalis, as useless, and we take honey from the remaining combs; say fifteen pounds—never more, seldom so much. Now, out of twenty hives served in this manner, not four would survive the winter, under favourable circumstances,—such as a protracted summer, or a superabundance of honey-dew; four out of twenty might stand the winter, but this, of course, must not be considered, as it will not do to depend on the probabilities of ensuing fine weather. We adopt the old plan: we suffer the hive to remain until August, and then destroy the bees in the usual mode;—and what is the result? There will be probably found forty pounds of honey. But then there is the cruelty of destroying the bees. I forget whether your correspondent objects to the method on this ground; but I think *he* leans most to the side of humanity, and adopts the best course, who destroys the bees by a speedy process, rather than by suffering them to drag on a miserable protracted existence, and at last to perish of absolute starvation. My object has been, in writing this letter, to prevent those, who may be inclined to adopt Mr. Cox's plan, from doing what will, I am persuaded from experience, prove fatal to all their bees.

I am, Sir,
Yours, &c.
INQUISITOR.

FIELD-GATES.



Sir, — "An Ex-Leicestershire Farmer," in Number 232, inquires of what use braces or stays are to gate-bars, and how they should be put on, so as to answer the purpose with the least consumption of timber? I will venture an answer to this inquiry, leaving your readers to judge for themselves. I would consider a field-gate to be constructed on the same principle as a large building, where principal rafters are introduced for the purpose of saving timber. I would suppose A A the rafters, and B the principal beam. I presume your intelligent readers can require no further explanation, as a slight inspection of the drawing will show

that this plan is well known amongst builders; and gates of this description have long been adopted in Lancashire for common fence-gates, and as requiring the least timber for ordinary field-gates.

I am, Sir,
Yours, &c.,
THE NORTH STAR.

MISCELLANEOUS NOTICES.

Extirpation of Thistles.—Sir; In your valuable Magazine for December, (No. 224, page 336), is an inquiry as to the extirpation of thistles. A friend of mine, who has passed twenty-five or thirty years in agricultural pursuits, assures me, that if your old friend S. will have the thistles spudded up the second week in May, the first week in June, and the first week in July, he will get rid of them.—Yours, J. E.

Microscopic Observations—their Uncertainty.—Bauer calculates the globules of the blood to be $\frac{1}{1760}$ part of an inch in diameter; Jurine $\frac{1}{1940}$; Dr. Hodgkin $\frac{1}{3000}$; Dr. Wollaston $\frac{1}{5000}$; Dr. Young $\frac{1}{6060}$; and Dr. Milne Edwards $\frac{1}{7500}$!! Bauer, Edwards, and others, describe the globules as being perfect spheres; Dutrochet thinks they are of a cylindrical form; while Dr. Hodgkin protests that they are flattened transparent cakes!!

Lusus Naturæ.—A Royal George *peach* tree, cultivated in the garden of the Rev. Mr. Howman, of Beccles, produced, last season, rather a large fruit, three parts of which were *peach*, and one part *nectarine*, quite distinct in appearance as well as in flavour.—*G. Fenn, jun.—Gardener's Magazine.*

Italian Tiles.—The roofs at Florence are covered with tiles of two different forms; a flat tile with ledges on the side, and nearly semi-cylindrical, but a little tapering upwards, which covers the interstice between the ledges of the flat tiles, and is named canale. These tiles are also used in Rome, and in many other parts of Italy; and tiles are found in ancient Greek and Roman buildings of a similar form, and sometimes made of marble. The tiles at Trieste and Venice are all of the tapering cylindrical form; a tile with the convexity outwards, being laid so as to cover the edges of the tiles of which the concave side is outwards.—*Journal of a Traveller.*

Heat.—Numerous experiments have lately been made in France, for the purpose of ascertaining the laws regulating the rapidity with which hot air passes through flues, &c. The results appear to be,—first, that flues oppose to the passage of hot air a resistance proportioned to the length of the pipe, the square of the rapidity, and in an inverse ratio to the diameter; secondly, that the co-efficient of friction is not the same with reference to different substances; thirdly, that by narrowing the superior orifice of a flue, the rapidity of the passage of the air through that orifice goes on increasing to a certain limit, which is the rapidity resulting from the pressure that takes place at the inferior end of the pipe; fourthly, that by narrowing the inferior orifice of a flue, the body of air passing through diminishes solely in proportion to the diameter of the orifice, and, consequently, that the rapidity in the orifice itself increases in an inverse ratio to its diameter.—*Literary Gazette.*

New Building for the Royal Academy.—Mr. Hobday has now in his possession, a very beautiful model, in plaster of Paris, of a new Royal Academy, with which the King has expressed himself very greatly delighted. It is divided into three compartments; the centre (over which rises an elegant dome), and two long wings. The centre is intended for the reception of sculpture, and the two wings for painting. The general height of the proposed building is to be about 100 feet. There is some talk, we believe, of its being erected in the open space at Charing-cross. The modeller is a young man of the name of Richard Day, who, until very lately, was a common stone-mason in the employ of Mr. Nash. His Majesty, we understand, has ordered him to construct a model of Windsor Castle, and another for a new palace.—*Weekly Review.*

Great Gun.—On a bastion near the Shawpoor gate of the ancient city of Beejapoor, is an enormous brass gun; its length is 14 feet 4 inches, the diameter of the bore 2 feet 4 inches, thickness of the metal at the muzzle 1 foot 2 inches 2 tenths, and at the vent 18 inches; it is capable of throwing a cast-iron ball of 3054lbs. weight, or 1 ton 7 cwt. 30lbs. The chamber will contain 428lbs. of powder. The weight of the gun, from a calculation of its solid contents (if all gun-metal), will be near 45 tons.

Fire Flies.—The light emitted by these singular insects (peculiar to South America and the West Indies) emanates from a convex spot on each side of the thorax, and shines forth or is extinguished at the will of the animal. The power of the light, when excited by the breath, or by friction, is so great that, carrying it along the lines of a book, they can be distinctly read by it, and applying it to a watch, the hour can be ascertained without difficulty. It is far more beautiful in colour, and greater in power, than the mild secretion of the glow-worm, or *lampyris noctiluca;* and the substance, if removed from the animal immediately after death, will remain luminous, like phosphorus, on the object upon which it is placed. At the Havannah, they are collected and sold for ornamenting the ladies' head-dresses at evening parties, when they are generally confined under gauze which covers the head, and from amongst the ringlets of hair these terrestrial stars shine forth with peculiar beauty.

Earthquake.—On the 15th of November last, at six o'clock in the evening, a shock was felt in the town of Popayan, about eighty leagues from the capital of Colombia, which was immediately followed by an undulatory motion, that lasted three or four minutes. The direction of this motion was from the S. E. to N. W. During the whole night the earth was sensibly affected, and every forty or fifty minutes a shock, more or less violent, took place. At three quarters after eleven in the morning, these shocks became so frequent and irresistible, that a large part of the town was destroyed. Several shocks afterwards occurred, until at length they were terminated by an eruption of lava, which burst forth from the neighbouring volcanic mountain of Purace, and swept away several villages through which it passed.

Stammering.—We mentioned in our 241st No. a cure for stammering, which a M. Malbouche, patronized by the King of the Netherlands, is practising with success in that country. It now appears, from a Report made on the subject to the French Academy, by a committee of which M. Majendie is the organ, that the original inventor of the plan is a Mrs. Leigh, of New York, who communicated it to Malbouche, in order that he might extend its benefits to the people of Europe, but that the details are still kept, by all the parties concerned, a profound secret. M. Majendie, with good reason, laments "that the inventor of the system, mistaking her real interest, and not sufficiently valuing the happiness of

being useful to her fellow-creatures, had not thought proper to conform to the honourable practice established in our days, of rendering public every discovery beneficial to humanity. Of the perfect efficacy of the plan there seems to be no reason to doubt. Since the year 1825, no less than 150 stammerers have been cured at an Institution in New York, opened by Mrs. Leigh herself; and the Report of the French Commission describes various cases of stammering which had, under their own eyes, been successfully treated by her method. M. Majendie remarks, that the system is known in England, and that the celebrated Mr. Dugald Stuart was cured by it of a vice of pronunciation caused by advanced age. But either M. Majendie is mistaken, or the system of Mrs. Leigh must be the same as that of Mr. Broster (now a resident in London); for it was by the latter gentleman our great moral philosopher was cured, and by that cure that Mr. Broster established his reputation.

New Thermometer.—A new instrument has been invented by a M. Fourrier, which he calls a thermometer of contact. Every one knows, that on touching different substances maintained at the same temperature, the same calorific impression is not received, in consequence of the different conductibility of those substances. If, then, on a support kept at a constant temperature,—for example, at that of melting ice,—thin sheets of different substances are successively applied, the simple contact of the naked hand will suffice to class a great number of them according to their order of conductibility. But this method is by no means accurate; and M. Fourrier's instrument minutely establishes the facts to which the application of the hand only makes an approximation. It consists of a cone of very thin iron, filled with mercury, and terminated at its circular base by a skin of moderate thickness. A thermometer is placed in the mercury. It is this skin which is put on the thin sheet applied to the support. The contact is very intimate, in consequence of its flexibility; and the thermometer indicates the variations of temperature. By this instrument, many curious facts have already been ascertained. For instance, it has been shown that the order in which thin sheets of different substances are placed upon one another, influences the quantity of heat which passes through them under the same external circumstances. Thus, the interposition of a sheet of leather facilitates the transmission of heat from the skin to cloth, it does not change it from cloth to cloth; and it obstructs it from cloth to marble.

Something besides Coals from Newcastle.—Mr. Loudon (Gardener's Magazine, No. for April) is of opinion, that the new system of heating by hot water, "will probably, in the end, render Newcastle and the other coal districts the chief sources for supplying London, Paris, and the great towns and cities of Europe, with forced fruit and vegetables, and with pine-apples and other tropical fruits." "It is in the order of things," he observes, "that those productions, the chief cost of which is heat, should, where heat is cheapest, be produced in the greatest abundance and at the least expense." Professor Aldini (the nephew of the celebrated Galvani) had a notion of a similar sort, and came from Italy to England on purpose to promulgate it. He thought, that as all our coals come from Newcastle, so ought all our gas-light; and that a grand manufactory might be erected in the midst of the coal districts, main pipes from which (mains indeed!) might supply every city, town, and village, in the kingdom with the quantity of gas they require, ready made.

Vegetable Transfusion.—Mr. William Falla, jun. states, in a communication to the Botanical and Horticultural Society of Durham, Northumberland, and Newcastle-upon-Tyne, that a gentleman in Herefordshire made the following curious experiment:—Having a very old golden pippin apple tree, which was in a dying state, he planted around it several young seedling crabs, and when they had established themselves, engrafted or inarched them into the trunk of the old tree; the consequence was, that, in the course of a year or two, the old tree became nearly as healthy as ever it had been, from the vigour that was infused into it by the sap of the young crabs that had been introduced into it.

Vegetable Inoculation.—It is mentioned in the same paper from which we have taken the preceding notice, that there is a blotched-leaved variety of the English laburnum, a bud of which being inserted in the bark of the common laburnum, it has invariably the effect (whether the bud lives or not) of making the leaves of the latter blotched, like the parent stock of the bud. "If," says Mr. Falla, "the blotched or striped leaves of the plants arise, as I think is generally admitted, from a disease, this may justly be considered as virulent a disorder in the vegetable world, as the small-pox is in the human race, and this operation may very fairly be said to be inoculation."

Potatoe Washing Machine.—Fleming's Farmer's Magazine for last month contains a description of a machine for washing potatoes, by John Lawson, jun. of Elgin. It consists of a wooden or iron trough with a moveable bottom above the fixed one, composed of spars three-quarters of an inch apart. The potatoes are laid over the moveable ribbed bottom, and water being admitted at one end by a cock, they are moved backwards and forwards by a wooden hoe, till they are clean, when the dirty water which has collected between the two bottoms is let off by another cock at the opposite end. There was a machine for the same purpose recommended by an esteemed Correspondent in our 1st vol. p. 360, which has been since pretty generally adopted, and is, we think, quite as simple as that of Mr. Lawson, and much better calculated to save trouble. We may remark, by the by, of this washing of potatoes, that it is a practice but too often followed, to the prejudice both of the article, and of consumers. Potatoes are never so good as when kept incrusted in their native mould till they are about to be put into the pot. It is owing to their being washed, and well soaked, and then exposed for sale in the open air for days and weeks, that they come so frequently tough and spongy to the table (in the metropolis and other large towns especially). Nor is this the fault of the dealers alone; there are few economical housewives who would not abominate the notion of having so much earth to the pound's weight, although, in point of fact, the potato gains generally more in weight by the water it imbibes in the washing process, than it loses by the mould from which it is freed.

NOTICES TO CORRESPONDENTS.

The Correspondence respecting Mr. Child's Inventions and Continuation of the article on Fluxions, is unavoidably deferred till our next.

Communications received from T. D.—W. N. C.—M. H.—E. J. M.—Mr. Brew—A Party—X. X. Inquirer—Scholasticus.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-Row, London.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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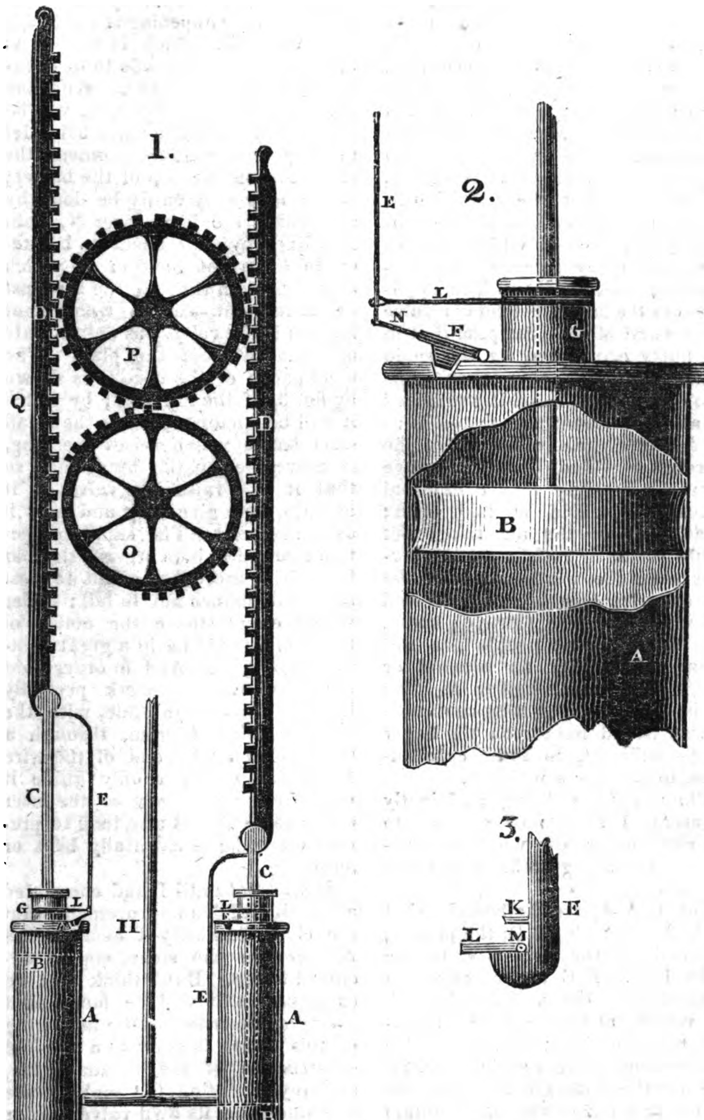
IMPROVED AIR-PUMP, AND PARALLEL MOTION.



IMPROVED AIR-PUMP, AND PARALLEL MOTION.

Sir,—As you have admitted several communications on the air-pump, I trust the following description and diagram will not be denied a place in your valuable publication. It is what I conceive to be an improvement upon the design given in No. 155, vol. vi. page 233; which although certainly in an *embryo* state, shows a great improvement on the old construction: but still it has several defects. *First*, The syringe-like motion of the piston-rod is both fatiguing and inelegant; *Secondly*, There being but *one barrel*, this motion is rendered still more laborious (the reason of which is given in almost every treatise on pneumatics); and, *Thirdly*, The application of the finger instead of a valve is the worst of all. Suppose that in the hurry occasioned by the rapid exhaustion which some experiments require, the finger should be snatched off at the moment the piston is at the *bottom* instead of the *top* of the barrel, it is evident that the passage from the receiver to the external atmosphere would be laid open; great part of the air taken out would instantly rush in again—perhaps even the whole of it—whilst the operator was bungling to find the small aperture (for you know, Mr. Editor, some people are not remarkable either for manual or *digital* dexterity),—not to mention the bad effect which long continued suction would have upon the finger itself—sufficient, in some constitutions, to produce a whitlow.

These defects being sufficiently apparent, I shall now proceed to describe, in as few words as possible, the drawing prefixed to these remarks.

Fig. 1, A A, are the barrels, shut at the lower ends; B B, the pistons, attached by the rods C C to the racks D D. E E are wires which proceed from the piston-rods C C, and which, at their greatest elevation, raise and let fall the plug valve F (shown on a larger scale in fig. 2). G G are the stuffing-boxes, containing ten or a dozen well oiled collars of leather, through which the piston-rods slide perfectly air-tight. Now it is evident, on the most superficial inspection, that when the piston B has descended to the bottom of the barrel A, air will immediately rush in from the receiver through the pipe H; and on the ascent of the piston will be condensed at the top of the barrel, and finally let out by the mechanical opening of the heavy plug valve F, which is turned of brass, and may be made to fit accurately without leather. And the perfection of the instrument will be seen to consist in the valve being let to drop at the same moment the piston strikes the top of the barrel; which may very easily be done by shortening the little lever N, until it is found by experiment to be precisely the right length; in which case it is plain that *all* the air must be taken out,—which would not happen if the valve was only a plate of metal without the plug. The mechanism of the wire E is shown by fig. 3, of the full size; by which it will be understood that the small steel bar I, which raises the plug, is moveable by the hinge M; so that it will raise the valve as it ascends, but give way and pass it as it descends. The small projection marked K is to prevent the bar from rising more than about 45°, lest it should chance not to fall; under which circumstance the action of the pump would be in a great measure destroyed. And in order that the wire E may work perfectly true, it is made to slide, with the least possible friction, through a ring placed at the end of the wire L; which will not only guide it with greater accuracy to the lever of the valve F, but also tend to prevent its being accidentally bent or loosened.

It was not until I had completed a drawing of this improvement, that the close similarity it bears to the *Scoggan* in the steam-engine occurred to me. But I think that on examination it will be found that the pump described at the beginning of this letter is very like the old construction of the steam-engine, and my invention for making the machine raise its own valve similar to *Master Potter's* improvement.

Now, Sir, although I certainly

think this also an improvement, yet I do not think I should have troubled you with it, had it not been for the admirable plan of parallel motion which accompanies it, and which was invented by a very ingenious young man with whom I was acquainted some years ago.

The action of this is so apparent, that it scarcely needs description. The handle is fixed in the usual manner to the axis of the lower wheel O, which being caused to revolve, turns the upper wheel P, which will elevate the one rack and depress the other, until the cogs Q come in contact with the opposite rack, which they will depress whilst the other is elevated, and so on. The wheels must be so made that the cogs of the lower one shall strike in between those of the higher at the moment they leave those of the rack. Thus we may produce an alternate rise and fall of the pistons, by a circumrotary instead of an oscillatory motion,—the advantage of which needs not be dwelt upon; and if the axis of the lower wheel were made to pass through the pump, and had a fly-wheel fixed on the other side, it would be better. This motion is also applicable to other pumps as well as the air-pump.

I am well aware of the great difficulty there is in inventing any thing *new;* so frequently does it happen that some one has previously stumbled upon the same plan, or (which will answer the same end) declares that he has; but I am certain that the individual alluded to *invented* this motion. I told him it bore some similarity to a pump of which a plate is given in one of Mr. Ferguson's works (*vide* "Ferguson's Lectures, by Dr. Brewster," vol. i. plate xiii. fig. 4); but he assured me he had neither seen the plate nor heard the name mentioned; and indeed it is, upon the whole, a very different machine: so I am in hope that this is the first time it has ever been presented to the public.

Now I am confident that if an air-pump were constructed upon these principles, it would be found to answer to admiration, so as almost to preclude the necessity of further improvement. And it is evident how useful such an apparatus would be to a public lecturer; for we cannot, by means of the common construction of air-pump, take out of the receiver more than about 19-20ths of the air it contains, and very frequently not so much; and this I know, by experience, to be insufficient for some experiments. But the lecturer might not be able to convince his audience of this; who would probably prefer attributing to his want of dexterity, what was solely the effect of the natural imperfection of his instrument.

I am, Sir, yours respectfully,

Exeter. H. J.

PUBLIC EXHIBITION OF BRITISH MANUFACTURES.

A project is now on foot for commencing an annual public exhibition of "Specimens of New and Improved Productions of the Artisans and Manufacturers of the United Kingdom," on the plan of the exhibitions of the same sort which have been for some years past established in France, the Netherlands, and United States. A committee of noblemen and gentlemen is stated to have been formed for the purpose of carrying the project into effect; but the only name of eminence which we have heard in connexion with it, is that of Mr. Agar Ellis. The following has been put forth as one of the resolutions of this Committee:—

"Resolved, That it appears to the Committee that it has been long a desideratum among our most intelligent merchants and manufacturers that an Annual Exhibition of specimens of new and improved productions of our artisans and manufacturers, conducted on a scale that should command the attention of the British Public, resident in and annually visiting the metropolis, would be highly conducive to the interests of the foreign commerce, as well as the internal trade, of the United Kingdom. And, in the opinion of the Committee, such exhibition will not only prove a powerful stimulus in promoting the farther

improvement of our already successful manufactures, but will also bring into notice the latent talents of many skilful artisans and small manufacturers, now labouring in obscurity, and sacrificing inventions valuable alike to the country and to themselves, from wanting such an opportunity of introducing them to the British Public."

We cannot, of course, but wish well to any plan which has the promotion of our arts and manufactures, and the encouragement of inventive talent, for its object; but we must confess we anticipate but little good from the project which has this ill-expressed and ill-grounded resolution for its basis. We doubt whether it can be said, with *truth*, that such an annual exhibition has been long "*a desideratum*;" and consider the notion of it to be, on the contrary, extremely at variance with the established tastes and habits of British artisans and manufacturers.

Exhibitions of this kind may suit countries where the arts are still, comparatively, in a state of infancy, and stand in need of every sort of adventitious aid; but appear to us to be wholly superfluous among a people like the British, who have, *without any such exhibitions*, eclipsed all other nations in the variety and excellence of their manufactures, and with whom supply and demand have long since worked out other and more natural channels for themselves. Is it seriously expected that the Boltons, the Wedgewoods, the Sturts, the Arkwrights, or the Bramahs, of our time will resort to such an exhibition as this in search of patrons and customers? And if they do not, what pretence can such an exhibition have to the character of a *national* one, as contrasted with the exhibitions of France, the Netherlands, and America? We think we may, beforehand, safely protest, in the name of the great body of British manufacturers, against this approaching exhibition being considered as emanating from them, or as offering any thing but a very imperfect representation of their industry and skill.

It is true that "many skilful artisans and small manufacturers" labour in obscurity and without reward; but the Committee have no authority for adding that it is "*from wanting* such an opportunity of introducing their inventions to the British Public" as the proposed exhibition will afford. The best way of trying the validity of this reason is, to ask what good such an exhibition will do to any person who may happen to fall upon some new invention or improvement? Will it enable him to defray the enormous expense of securing the right to his invention by patent? It is this enormous expense that is the real grievance from which the humbler order of artisans and manufacturers require to be relieved; and on this grievance the projected exhibition has no practical bearing whatever.

It would seem that Government (or at least some departments of it) are disposed to think more favourably than we do of the plan; for, since writing the above, we perceive, from another paragraph in the newspapers, that the Commissioners of Woods and Forests and the Board of Ordnance have granted to Mr. Ellis and his Committee of Management "the use of the extensive and commodious gallery and range of rooms in the King's Mews at Charing-cross" for the purpose of the exhibition; that "workmen are now busily employed in making the necessary preparations;" and that it is expected the exhibition will open as early as the month of May next.

WEST INDIA COFFEE.

Two coffee plants were sent under the care of a French botanist to the West Indies, from the Botanic Gardens at Paris; but on the voyage the supply of water became so nearly exhausted, that he was forced to deprive himself of the greater part of his individual allowance, in order to water and preserve the plants alive. From these two all the coffee grown in the West Indies has sprung. Formerly coffee could only be procured, at a great expense, from Mocha.

CIRCULATING DECIMALS.

NOTICE OF THE LATE HENRY GOODWYN, ESQ.

Sir,—I cannot but conclude, from the communication of your ingenious correspondent, Mr. Utting, in the 242d No. of your Magazine, as well as from a paper on the subject of circulating decimals in No. 3 of "*The Verulam*," that the interesting and laborious researches of the late *Henry Goodwyn*, Esq. of Blackheath, in reference to that curious class of numbers, are by no means so well known as they ought to be. Yet it is matter of scientific history that, in the "*Ladies' Diary*" for the year 1823, a question was proposed by Dr. *Gregory*, of the Royal Military Academy, to the following effect; the same being answered in the "Diary" for 1824, by Mr. *Barlow*, of the same institution, by Mr. *Isaac Brown*, of Epping, and other men of known science. The question was thus proposed :—

"If the fraction $\frac{1}{23}$ be converted into a decimal, it will be a repetend, or circulate; viz.

$$\cdot\dot{0}4347826086\,9565217391\dot{3}$$

in which these properties obtain.

"1. The number of places in the circulating period is 23—1; and whenever the denominator is a prime number n (except 2 or 5), the number of places in the circulating period is always either $n-1$, or $(n-1) \div m$, m being an integer less than n.

"2. The first and the last half of the period consist of figures, which, added, term by term, constantly make 9: as $0+9$, $4+5$, $3+6$, &c.

"3. The same circulating period includes all the repetends respectively equivalent to $\frac{2}{23}$, $\frac{3}{23}$, $\frac{4}{23}$, &c., each commencing at an easily assignable place: thus, $\frac{3}{23} = \cdot13043478$, &c.

"Required a demonstration, &c."

In Mr. Brown's demonstration, he presents another property, namely,—

"If the several remainders arising from the reduction of $\frac{1}{23}$ to a decimal be ranged into two periods, as

10, 8, 11, 18, 19, 6, 14, 2, 20, 16, 22,
13, 15, 12, 5, 4, 17, 9, 21, 3, 7, 1,

the sum of any two vertical terms will always be 23."

In these properties, as you will perceive, the results announced by Mr. Utting are completely anticipated; and in both Nos. of the "*Ladies' Diary*" specific reference is made to Mr. *Goodwyn's* publications, of which, as well as of himself, you will perhaps allow me to say a little.

Mr. *Goodwyn*, who was for some years the principal of the firm of Goodwyn and Co., brewers, was obliged to retire from the pursuits of active life nearly thirty years ago, in consequence of severe lameness and other disorders. Happily, however, he slid into retirement with competent property; and, being surrounded by an affectionate family, whose constant aim was to promote his comfort, he passed not merely with content, but with delight, from the occupations of a commercial man to those of a student, and at length to those of a most laborious computer.

Mr. Goodwyn being not a man of profound science, had too much good sense to attempt higher inquiries, but devoted himself to the investigation of the properties of numbers, among which those which relate to circulates engaged most of his time and thoughts. Being often confined to his bed for weeks, nay months, by his complicated disorders, he invented various mechanical expedients for the abridgment, as well as the correctness, of his computations, and frequently was he enabled to derive such pleasure from his results (new to himself, and, in many cases, new to the world), as completely to overcome the sense of pain.

Some of Mr. Goodwyn's earliest results were communicated to "Nicholson's Journal;" and it is one of these, I presume, to which Mr. Utting refers. Others he printed

at his own expense, for private circulation among his friends. Others, relating to the reduction of weights and measures, and other practical inquiries, have been long before the public; and some of them have been announced in your useful Magazine.

His first express publication on the properties of circulates was laid before the world in 4to. in 1818. I quote the entire title, notwithstanding its length, since it is tolerably descriptive of the nature of its author's labours:—"The First Centenary of concise and useful Tables of all the *Complete Decimal Quotients* which can arise from dividing a Unit, or any Whole Number less than each Divisor, by all Integers from 1 to 1024. To which is now added, a Tabular Series of Complete Decimal Quotients, for all the proper Vulgar Fractions, of which, when in their lowest Terms, neither the Numerator nor the Denominator is greater than 100: with the equivalent Vulgar Fractions prefixed."

In the introduction to these Tables Mr. Goodwyn exhibits various properties, marking the relations of *prime numbers* and *circulates*, among which are those already specified in this letter. He also presents a new method of carrying on the divisions by 17, 19, 23, &c. at once concise, accurate, and universally applicable. This, on some future occasion, I shall do myself the pleasure to transmit for insertion in your Magazine.

In 1823 Mr. Goodwyn published, in royal 8vo. "A Table of the Circles arising from the Division of a Unit, or any other Whole Number, by all the Integers from 1 to 1024; being all the pure Decimal Quotients that can arise from this source."

And the same year also, in another royal 8vo. vol., "A Tabular Series of Decimal Quotients for all the proper Vulgar Fractions, of which, when in their lowest terms, neither the Numerator nor the Denominator is greater than 1000." Of this latter work only the first part is printed.

These volumes are elegantly printed, and, I believe, with unusual correctness, by *Marchant*, of Ingram-court; and sold by *Richardson*, 23, Cornhill, *opposite* to the Royal Exchange.

In the first of these 8vo. volumes, the arrangement and appearance of the complete decimal quotients, some of which comprise several hundred figures, are really beautiful; at once reflecting considerable credit upon the author, the type-founder, and the printer. There are also some useful subsidiary Tables, and a curious Table for the calculation of *Simple Interest for Days*, introduced in order to show that these curious properties of circulates are not barren speculations, but are susceptible of important applications to practical purposes. I am glad to observe that Dr. Gregory, who has availed himself of many opportunities to draw the attention of the public to the curious researches of his friend, has inserted this Interest Table, with a subsidiary tablet and illustrative examples, in an Appendix to a new edition of "*Hutton's Arithmetic*," which has recently issued from the press.

The "Tabular Series" contains the equivalent decimals, carried to *eight* places, to all the vulgar fractions, with three figures in the denominator, which can be formed, between

$$\frac{1}{999} = \cdot\dot{0}0\dot{1}$$

$$\text{and } \frac{99}{991} = \cdot\dot{0}9989909.$$

To extend the utility of the Table, the author shows that "each of the entered quotients, with its equivalent vulgar fraction, throughout the Table, has a *complementary*, or *unentered quotient* and *equivalent vulgar fraction*, derivable from the former by the following easy and expeditious mental progress:—

"The *complement* of the numerator of any given *entered* vulgar fraction to its denominator, and the *complement* of its given equivalent decimal quotient to *unity*, or the *nines*, will be the complementary or unentered quotient required."

Examples.

Entered			Complementary, or Unentered		
Vulgar Fractions.		Decimal Quotients.	Vulgar Fractions.		Decimal Quotients.
49/806	=	·06079404	757/876	=	·93920595
	29/477	·06079664		448/477	·93920335
38/625		·0608	587/625		·9392.
	47/773	·06080206		726/773	·93919793
56/921		·06080347	865/921		·93919652
	9/148	·06081		139/148	·93918

It is at once evident that, besides many other uses of such a Table, it serves admirably for finding a vulgar fraction whose value shall approximate very nearly to a given decimal, and *vice versâ*.

Mr. Goodwyn's valuable life was terminated when he had published only the first of *five* parts of this Table. But the manuscripts of the entire Table, computed and *verified* with great care by the author himself, have been presented by his family to the British Museum, with other interesting results of his long continued labours.

I *think* that an account of those manuscripts was inserted in your valuable publication,* as well as a few other scientific periodicals; but, as I write this at a time when I am unable to consult my library, I cannot make a specific reference.

I shall be thankful if this hasty account serve to make more generally known to your readers the truly valuable researches of Mr. Goodwyn; and remain sincerely the Mechanics' Magazine's

Old and Cordial Friend.

* It will be found at p. 357, vol. vii. —Ed.

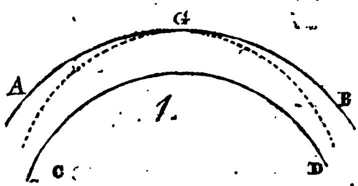
NEW METHOD OF SCRIBING.

Sir,—If the following description of a new method of scribing should be thought worthy of a place in your excellent Magazine, you will oblige me by inserting it. Being convinced the method of scribing practised by workmen was inefficient, I determined to try if I could contrive something to do it with accuracy; and I have succeeded. Considering that it may be of service to many workmen, I am anxious to make it known through the medium of your pages.

What is meant by the term scribing, is;—Supposing a joiner has two pieces of stuff, and is desirous of making the one exactly fit the other, he lays the one which he is desirous of fitting, as close as possible to the other; he then takes a pair of compasses, and sets them to the greatest distance that the two pieces are apart; he then slides one of the legs along the edge of the former, whilst the other leg makes a mark on the latter parallel to the edge of the former; and if he works his stuff away to this mark, it is said that the two pieces, when put together, will seem a joint: but it must be obvious to every person

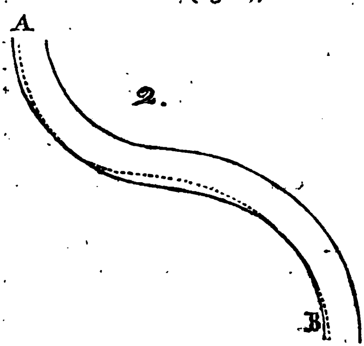
who will think a little on the subject, that this can only occur when the edges are straight; for if two curved lines are parallel when they are brought to touch each other, they will only touch in one point.

The curved lines which I have drawn (fig. 1), will perhaps better



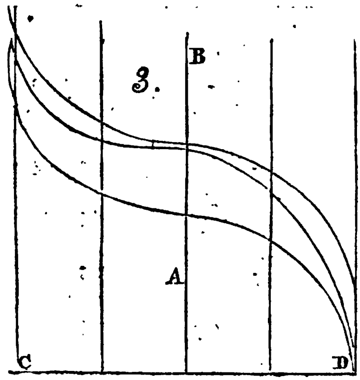
explain my meaning. The line C D is parallel to A B; now, if C D be made to touch A B, as shown by the dotted line, it will only touch it in the point G. I think this example is enough to prove to every one that this method of scribing is inefficient; but if it will not be trespassing too much on your pages, I will take another example.

Supposing a joiner had a piece of stuff to fit to A B (fig. 2), he would



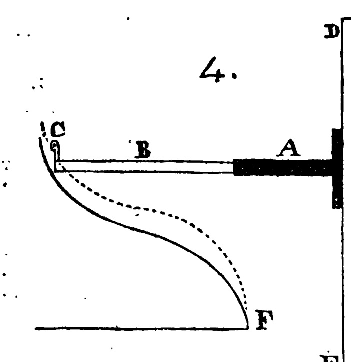
have to scribe it several times. It would, however, at last seem a joint; for by bringing it closer each time, there would be but very little variation in the curves. Now, by my method this can easily be done at once; for it must be obvious that to make it fit it must be exactly the same figure; but in the case of scribing with the compasses, we in one part describe the part of a smaller circle, and in the other a part of a larger, as is shown by the dotted lines.

Now, suppose A (fig. 3) to be a



piece of stuff having one edge shaped similar to A B (fig. 2), and B to be another piece with an irregular edge;—lay the piece B close to A, and draw several lines upon them perpendicular to the line C D, and take the greatest distance in the compasses, and prick it off on each perpendicular; draw a curve through all these points; which curve will be found to fit the given figure: but this method is, perhaps, as tedious as the old one; therefore I only mention this, that the principle upon which my instrument acts may be the better understood.

The instrument consists merely of a T square A (fig. 4), having its



blade made hollow, for the purpose of receiving the moveable blade B, which must be made to slide per-

fectly steady. Upon the end of the moveable blade is fixed a moveable gauge, so that it may be set to different distances. The method of using it is very simple: it is only required to fix a straight edge D E (as in fig. 4), and to set the gauge to the greatest distance, and to begin at the point F to draw the blade gradually out, keeping the corner G close against the edge with one hand, whilst the square is to be kept close against the straight edge, and moved along with it with the other hand. The gauge will then describe the figure exactly, as is shown by the dotted line, fig. 4.

I am, Sir,
Yours, &c.
JAMES CURTIS.

P. S. I forgot to mention that the gauge must stand at a right angle with the blade.

INQUIRY INTO THE FALL OF THE BRUNSWICK THEATRE.

ADJOURNED INQUEST.

(Concluded from page 174.)

April 9.

John Boyd, clerk of the Surveyor-General of the Board of Ordnance, proved that an iron roof, made and supplied by the same person (Mr. Wellington) in March, 1821, for the Cavalry Barracks, Glasgow, fell in, whilst in the course of being covered with slates.

Models of the roofs of the Brunswick Theatre and the Glasgow Barracks were produced, and the Jury, having surveyed them, expressed themselves satisfied that the roof of the Theatre had been superior in substance and in construction to that of the Glasgow Barracks.

Mr. Moorman, smith and iron founder, of Old-street, St. Luke's, said, that he considered the roof of the Theatre was capable of sustaining, suspended from it, a moderate dead weight safely, but not a weight causing a vibration. He should prefer an iron roof to any other.

Messrs. Nash and Smirke were then sworn, and said they had come to the following opinion on the subject of the accident:—"After a careful inspection of the ruins of the Brunswick Theatre, and of the drawings of its construction exhibited to us, and having read the various depositions made concerning it, we are of opinion, that the principle upon which the roof was constructed was injudicious, unsafe, and improper for a theatre; that the walls were not in a condition to support the weight that such a building must necessarily charge upon them; and that the manner in which the flooring of the several circles of boxes and of the gallery was supported, as it is still seen in part of the building that remains, was very weak and improperly executed. It is, however, impossible for us to point out which of these causes led to the immediate destruction of the Theatre; but from the account given by several of the deponents, describing the use that was made of the roof, and the change that was observed in the form of different parts of it several days before the fall took place, we are of opinion that the roof gave way, and, by its fall, destroyed the weaker parts of the building."

In answer to other questions, Messrs. Nash and Smirke said, that the mortar was not judiciously used, and did not adhere to one-third of the bricks; therefore the roof was not calculated to have any weight suspended to it: that having regard to the number and size of the openings, they thought the building insufficient to support the roof: that the roof was improperly constructed, inasmuch as the principals were all parallel, and if one of them gave way, the whole would fall like a pack of cards; and that the walls were not of sufficient thickness. Mr. Nash said, he knew that the roof was a most dangerous one; and if no other cause existed, he was of opinion that the weight improperly appended to the roof was a sufficient cause to account for the accident.

Mr. Hill said, that the opinions of many scientific gentlemen differed materially from those of Messrs. Smirke and Nash, and he proposed that they might be examined on a future day.

The Jury said, they were satisfied with the evidence already given, and the Coroner proceeded to read the whole of the statements of the witnesses prior to giving his charge, after which the Court adjourned till the following day.

THE VERDICT.

On the 10th of April, the Coroner charged the Jury at great length, and on the next day the Jury returned the following special verdict:—

"The Jurors charged to inquire touching the cause of the deaths of the deceased persons (whose names were set

forth), unanimously return the following special verdict:—

"*First*—Accidental Death as to the above-named parties, caused by the fall of the iron roof, with the matters and things attached thereunto, and therefrom pendant, and a part of the front wall and balcony of the messuage in Wells-street, known as the late Royal Brunswick Theatre. They further find, that the said lamentable accident was caused by the hanging of heavy weights improperly to the iron roof.

"*Secondly*—That the weights so improperly hung, were so placed by the orders of the Proprietors. They further find, that many warnings had been given to the Proprietors. They further find, that sufficient indications of failure appeared, of which Mr. Carruthers was cognizant, which ought to have been sufficient to have induced a prudent man to have closed the Theatre, until the danger apparent from such indications had been provided against. The Jury return, as a deodand, the substances which moved to and caused the death of the aforesaid persons, viz.—the iron roof and gutters, slates, hips, and fastenings, and, in fact, all the usual parts of the roof; also the carpenters' and painters' shops, the flies, the girders which supported the shops, one of the proscenium posts, part of the balcony, and cantilevers; also that part of the front wall described by the witness Finlay to have fallen. They do not find the geometrical staircase to have moved to the death of the deceased persons, nor do they know the value of the said substances."

REMARKS.

The verdict of the Jury is in perfect accordance with public opinion, in so far as it attaches the chief blame of this melancholy occurrence to the Proprietors of the Theatre. They had "many warnings" of the insecurity of the roof, and yet persisted in running all risks, rather than submit to the delay and expense which would have necessarily attended any remedial measures.

It is only fair, however, to the proprietors, to observe, that the effect of these warnings on their minds must have been naturally much weakened by the admitted fact that not one of all the warning parties seems to have himself acted upon them, to the extent of shunning the danger which each professes to have apprehended. Neither can we bring ourselves to believe that the sense of danger could at any time have been so strong as it is now represented by some of the witnesses to have been, when we find, that down to the last moment they one and all exposed their own persons, as if there was no danger whatever in the case. We think there was a vague sort of impression prevailing among all the parties concerned, that the building was *not just the thing;* but that it might, nevertheless, and would, most probably, answer all the purposes for which it was designed. Were we to give any individual credit for more, we must look only to what he has been pleased to say of himself, and throw out of view entirely the manner in which he acted. The proprietors seem to us to have been only more culpable than others, because they were more responsible than others; the slightest hint that there was any thing defective in the building, should have been sufficient to induce them to make instant inquiry into the fact, and to see that every chance of danger was obviated.

The sole cause of the accident is declared by the jury to have been "the hanging of *heavy* weights improperly to the roof." On this point it will be observed, that their judgment is somewhat at variance with the evidence of the professional men whom they called in to their assistance. For though Messrs. Nash and Smirke do state that one of the likeliest of several causes was, that "the roof gave way, and, by its fall, destroyed the weaker parts of the building;" they affirm, at the same time, that "the principle on which the roof was constructed, was injudicious, unsafe, and improper;" that it was not, in fact, "calculated to have *any weight* suspended from it;" and that, independently of this, the walls were "not in a condition to support the weight that such a building must necessarily have charged upon it." Where there were so many errors and defects, all tending to the same

result—the downfal of the building, —it would have been as well if the jury had imitated the discreet reserve of their scientific assessors, and pronounced a more general verdict. As it is, however, the public will probably be at no loss to decide which is most deserving of respect,—the judgment of men of the scientific knowledge and practical skill of Messrs. Nash and Smirke, who declare that they cannot presume to say positively, which of several adequate causes was the immediate one of the calamity in question—or the judgment of a jury promiscuously selected from the inhabitants of the district, who have been pleased to find, that there is no doubt about the matter!

On referring to the evidence of the architect of the building (p. 122), it will be seen that he entertains an opinion of the construction of the roof very different from that of Messrs. Nash and Smirke. "The iron roof put up was much lighter than a wooden one would have been; *it was judiciously constructed;* and the contractors are, in the opinion of the witness, free from all blame." It may occur to the reader that the architect is here a witness in his own behalf; for though Mr. Whitwell has excepted many things about the building, as not coming within his range of responsibility, it has never been said, nor can it be said, that it was not a part of his duty to see that the walls which he erected had a sufficient roof put over them. We think, however, that no stress need be placed on the motive which Mr. Whitwell has to speak well of the roof; since it is a matter of easy proof who is in the right with respect to it—Messrs. Nash and Smirke, or Mr. Whitwell. An authentic plan of the roof will at once put the question beyond all cavil. We subjoin one with which we were lately favoured by a correspondent, along with some very pertinent remarks on the subject; but of the authority on which it is given we can say nothing. Should it not be a fair representation of the actual construction of the roof, we shall readily give insertion to any better one which may be sent to us. But should no objection be made to the correctness of our correspondent's premises, we think none can be offered to the soundness of his conclusion,—that a roof so constructed was "not calculated to carry much weight—*scarcely the covering;*"—a conclusion, it will be observed, which agrees precisely with that come to by Messrs. Nash and Smirke.

The opinion given by these gentlemen with respect to *the walls*—that they were of insufficient thickness for a building of such magnitude—suggests an important general consideration. Whether thick enough or not, they were at least thicker than they were required to be by the provisions of the Builders' Act. (See these explained, p. 123, No. 239.) And either Messrs. Nash and Smirke are in error in this respect, or the Act ought to be forthwith amended.

The following is the letter on the roof, to which we have above alluded:—

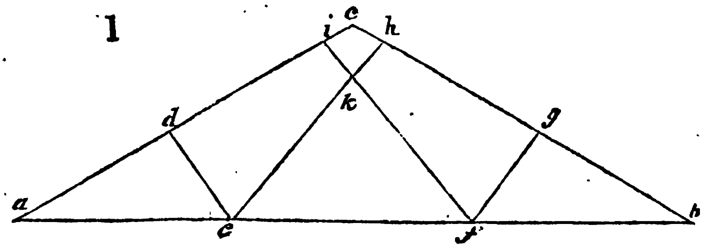
Sir,—I send you herewith an Outline of the Construction of the Roof of the late Brunswick Theatre, in the hope that you will give it place in your valuable work, the "Mechanics' Magazine."

Fig 1 (next page).--*a b* is the tie beam; *a c* and *b c* are the principal rafters; *d e f g* are two struts; *e h* and *f i* are two braces; and *k*, the intersection of the two braces. Now it is evident, that this roof is not calculated to carry much weight—scarcely the covering; for if any weight be hung to *e* and *f*, it will pull down the beam, and the rafters must follow, and break the braces at *k*: likewise if the weight be put on *d* and *g*, it will have the same effect as when loaded at *e* and *f*; for those braces standing in a raking direction to each other, are not calculated to carry a weight.

I will give you an outline of a roof that is as light as the above, and will carry three times the weight.

Fig. 2.—*a b* is the tie beam; *a c* and *b c* are the principal rafters; *e c* is the king post, united to the

1



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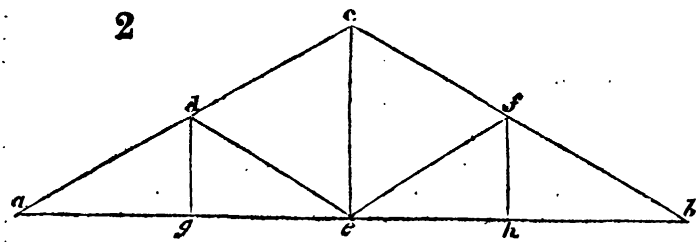


rafters at *c*; *d e* and *f e* are two struts united to the king post and tie beam at *c*; *d g* and *f h* are two queen posts united to the two struts and principal rafters at *d* and *f*. Now, if a weight be hung to *g* and *h*, it will throw the weight on the struts at *d* and *f*, the bearing being pitched on the bottom of the king post at *e*; and the king post being united to the rafters at *c*, will prevent the tie beam from deflecting.

I am, Sir,
Yours, &c.
ROBERT TROW,
Journeyman Carpenter.

LONDON
MECHANICS' INSTITUTION.
NO. XIV.
Lectures.

"The *history* part lay within a little room."

Friday, March 7th.—Mr. Hemmings in continuation—Chemistry.

Wednesday, 12th.—Mr. Brown in continuation—History.

Friday, 14th.—Mr. Hemmings on Gases.

Wednesday, 19th.—Mr. Brown, History.

Friday, 21st.—Mr. Hemmings on Gases.

Wednesday, 26th.—Mr. Brown, History.

Friday, 28th.—Mr. Hemmings, Gases; and concluded his course.

Professor Brande has signified his intention of delivering a Course of Lectures, according to a former promise.

On account of the disastrous roof affair, and the consequent discussions which have necessarily arisen, as far as regards pecuniary matters, it appears that the Institution is able, from calculations which have been made and may be relied on, to support itself without donative aid, even though its present numbers should not be increased. This intelligence must be very gratifying to the members; at the same time, it affords strong and melancholy proof that the funds must, at the commencement, have been miserably managed. The Committee of Inquiry obtained some useful information on this point, which will be a lesson to the members, and teach them to act for themselves, and not suffer an individual of influence to sway their minds, as it was proved was the case. If the Committee-men would rely more on their own judgment, and less on the advice of some two or three, more good might be done. It may be offered as an excuse for the past management, that they were inexperienced; but a man who does not know how to take care of

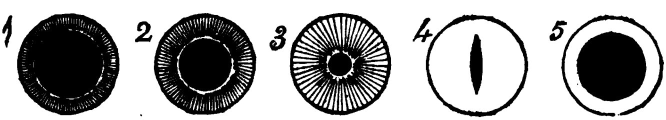
money, or who, because there is plenty at the present moment, does not beware of a rainy day, is but a poor sort of a being. The present, and the last two or three Committees, deserve the best thanks of the members for their rigid economy and excellent arrangements; and when the Institution has recovered its late shock, there is no doubt but it may and will permanently prosper.

Erratum in our last report. Page 142, col. 2, line 16 from bottom, for "two journeymen," read "*the* journeymen." ☞

REMARKABLE OPTICAL FACT.

Sir,—For some time past, my attention has been forcibly called to one of those wonderful contrivances which abound in the human frame. Though the circumstance I am about to relate was not altogether unknown to me theoretically, I was certainly very much surprized when it came immediately under my practical observation. A few evenings since, I was looking in a mirror at the reflection of a small spot in the iris of one of my eyes; and, in order to examine it closely, I brought the candle, which I held in my hand, as near as possible to the eye; I was immediately surprized at the great diminution which took place in the apparent size of the pupil; on looking a second time, and moving the light backwards and forwards, I observed that this was caused by the expansion of the iris, which lessened the circular aperture in the centre, through which the pupil is seen. I have since observed the apparent size of the pupil in light of different intensities, and herewith I send a sketch of the eye in various states, as regards the pupil and iris.

1 2 3 4 5



No. 1. The human eye in a dim light.

2. The same sight in a moderate daylight, or candlelight.

3. The same in a very strong candlelight. The contraction is still greater in the full blaze of the sun's light.

4. A cat's eye in the sunshine.

5. The same in a dim light.

I suppose, Sir, that most of your readers know that the contraction and expansion of the iris are intended to regulate the quantity of light admitted to the pupil; but I dare say few of them were aware of the degree to which it extends, and it may surprise them as much as it did me.

On looking into a philosophical work, I find this circumstance thus stated:—"The choroides (of which the iris forms a part) expanding, contracts the pupil;" and again, "The choroides contracting, expands the pupil." Now, as the expansion of the pupil must decrease its convexity, and *vice versâ*, will any of your readers be kind enough to inform me why the rays of light, proceeding from any object in such a case, do not form a focus either behind the retina or before it, thus obscuring the vision.

I am, Sir,
Yours, &c.
JOSEPH BROWN.

Cannon Street,
March 20, 1827.

[Mr. Brown, in a letter which we have since received from him, says, "Since writing to you on the above subject, I have discovered that the author of the philosophical work to which I referred, meant nothing more by the expressions 'contraction' and 'expansion of the pupil,' than the apparent increase or diminution in its size occasioned by the actual expansion or contraction of the iris."]

CURIOUS EXPERIMENT.

Sprinkle a tray with some water; place a watch-glass on it, in a con-

vex manner; raise the tray on one side, and the glass will revolve down the tray. Without the water, it will slide down.

Query.—The principle by which the water thus affects the motion of the convex glass?

W. H. B.

Ringwood.

MR. DEAKIN'S PLAN OF TUNNELLING.

Sir,—"A Young Engineer," in criticising my plan of tunnelling under rivers, tells you there is nothing *new* in it. Now, as he has before requested me to answer him several questions concerning it, which I have endeavoured to do, I think, in fairness, he cannot refuse to answer me a question or two in return.

First, then,—When or where did he ever see, either on paper or in practice, a tunnel made upon the principle of the one I have recommended through the medium of your useful Magazine?

Secondly,—Where or how did he obtain mining experience sufficient to constitute him a proper judge of my plan of mining a tunnel? I have no doubt but he has been in the Thames Tunnel, and so was Don Miguel *(a day too soon)*; but that, as we have all seen, has been no school of wisdom. Hoping your "Young Engineer" will grow wiser as he grows older,

I am, Sir, &c.

THOMAS DEAKIN.

Blaenavon Works,
5 *April*, 1828.

MESSRS. WOOLLGAR AND LAWRANCE'S CALENDARS.

Sir,—A desire of rendering a calendar on Mr. Woollgar's principle more compact and comprehensive, not the good opinion I had of my own performance, induced me to send you a description of mine. The opportunity given of referring to dates 27 years anterior, and 72 posterior, to the present, comprising in the whole a century, without any calculation, and that in less space than Mr. W.'s occupies for 28 years only, effects this; but whether it is of more practical utility, your readers must judge for themselves.

I am aware that Mr. W. can make his calendar equally comprehensive, by increasing its size. This remark I intended to make in my description.

With regard to the postscript Mr. W. alludes to, I have to observe, that a person constructing a calendar of this description merely by the directions given, would be at a loss to reply. This may account, in some measure, for the silence Mr. W. complains of. A knowledge of its principles removes this difficulty.

In preparing the months for insertion on the concentric circle, they are arranged according to the day of the week on which they respectively commence. This arrangement differing in a leap year, two series are necessary; each series is made to circulate. To effect this, each would require 13 compartments, making, in the whole, 26; but two successive compartments in each series having the same months (June, Sept. Dec.), the months are so arranged round the circle that the two compartments (June, Sept. Dec.), Nos. 1, 2, in the Table, end the series for the common years, and commence those for the leap-years,—thus effecting a saving of two compartments, and rendering no more than 24 necessary. This explanation will, I trust, be sufficiently satisfactory. I remain, Sir, &c.

W. H. LAWRANCE.

April 8, 1828.

TEST OF DIAMONDS.

The real diamond is *never set on a foil;* yet when it is looked at perpendicularly, a small black point appears in the centre, while the rest appears sparkling. Jewellers, to pass off their Brazilian diamonds as real ones, set them on a foil, with a black point in the centre, and thus often deceive even those who pretend to connoisseurship. The reason of the diamond's showing a black point is, that the ray of light which falls on the centre passes through, and is lost, while all the other rays are refracted and reflected to the eye.

MISCELLANEOUS NOTICES.

Degeneracy.—Captain Lyon relates, in his Travels in Mexico, that when at St. Juan, every woman (he believes), and the greater part of the men, came at different times to see his watch and writing case,—curiosities, neither of which had ever before been exhibited in that place. "Their astonishment," he says, "on hearing the watch tick, and seeing its wheels in motion, was really as great as ever I saw displayed by either Negroes or Esquimaux; yet these people were all white, and the descendants of Spaniards. A venerable old man, whose opinions seemed to carry great weight, remarked, that 'it was a folly to give a number of dollars for a thing just to know how many hours it was from morning or night; that to know when to eat and drink, when to get up or lie down to rest, was quite sufficient;' —a remark which, with these primitive (?) people, met with very general approval."

Advice to Governments.—Buffon regrets that the labour bestowed by the slaves of the Egyptian kings, in heaping on the earth monuments of their pride, was not rather employed in digging to a great depth. It is, indeed, astonishing that governments have not yet perceived the practicability and advantage of penetrating, at a small expense, into the nucleus of some of the most elevated primitive mountains. We might thus, in the course of a few years, discover at last the virgin granite in its native position—that is to say, in the very laboratory where nature formed it, in the same situation as it was placed originally, and accompanied with all the circumstances necessary to a perfect understanding of the mode of its formation. For there is no reason to believe that these interior masses have been ever displaced; every thing indicates, on the contrary, that they have remained immoveable amidst all the changes which the exterior surface has undergone, and are, in short, the unaltered remains of the first crust of the globe.—*Guyton de Morveau.*

Short-going Clocks.—When the public clock for the Royal Hospital, Greenwich, was about to be made, Mr. Smeaton, the celebrated engineer, and the Rev. William Ludlam, professor of Mathematics, at Cambridge, both very competent judges of matters of this sort, strongly recommended that it should be made to go only thirty hours; but their advice was overruled. Mr. Ludlam humorously observed, "it was grudging shoe leather to serve a good purpose." Many of the old tars in the hospital would, for a trifle of tobacco, have gone every morning up to the cupola and wound up the clock. It is certain that short-going clocks keep by far the best time, and long-going ones—month clocks especially—the worst. The fine clock in the Hotel de Ville, at Paris, and those of St. Paul's and the Horse Guards, London, are all day-clocks.

Preservative against Rust.—Lampadius states, that the following composition is an effectual preservative of iron from rust. One ounce of jet ground to the finest powder, four ounces of vitriol of lead, and one ounce of white vitriol, mixed in a pound of linseed oil varnish, and stirred carefully over a slow fire, till the mixture attains a boiling state.

Beer Engines.—Sir,—Mr. Baddeley's notice, in your 238th No., of the applicability of the new caoutchouc hose or pipes, to *beer*, as well as fire-engines, has recalled forcibly to my mind the statement made by another of your correspondents, some time since, that Mr. Farraday (I think) had ascertained, by an examination of a number of pieces of leaden pipe, which had been employed in the pumping up of malt liquors from the cellars to the bars of public-houses, that the metal had been corroded by the liquor, to which they must, of course, have imparted a directly poisonous quality. It is doubtless owing to this, that dyspeptic affections are so common among persons who indulge in malt liquors. It is to be hoped, that now caoutchouc pipes, free from every injurious tendency, can be so readily substituted, the use of metallic pipes will be forthwith wholly abandoned. I am, &c. *Medicus.*

Cure for Tooth-ache.—A sheet of writing-paper, burned on a clean white plate, will leave a yellowish oily residuum; take this up with a small piece of clean cotton, and place it in the affected tooth; in about a quarter of an hour, the pain will, in nine cases out of ten, be completely removed.—S.

Cusps of the Moon.—The position which the cusps, or points, of the new moon exhibit, when first seen, has been always made a great handle of by astrologers. The following simple and rational account of this varying phenomena, is given in the *Companion to the Almanac:*—"These (the cusps) are always both at equal distances from the sun, and of course, their standing straight, or leaning backwards or forwards, depends upon the distance that the moon is north or south of the sun. Any one can see this by a very simple experiment. Take an orange, or an apple, or any thing round, and hold it in your left hand between you and the candle, only as far to the left as that the light will shine on a part of it, in the shape of a new moon. This moon may be much narrower or broader, according as you hold it nearer or farther from the line between you and the candle. If you hold it just as high as the candle, the line of the points will be upright; if you move it higher than the candle, the line will lean backwards, more and more, as it is raised; and if you move it down lower than the candle, the line will lean forward, more and more, as it is lowered."

Tortoise-shell.—Few of the *tender* sex (it is to be presumed) are aware of the barbarous method by which this highly prized article is obtained. "When the tortoise," says the Sincapore Chronicle "is caught by the Eastern islanders, it is suspended over a fire kindled immediately after its capture, until such time as the effect of the heat loosens the shell to such a degree, that it can be removed with ease. The animal, now stripped and defenceless, is set at liberty, to re-enter its native element. If caught in the ensuing season, or at any subsequent period, the unhappy animal is subjected to a second ordeal of fire; but rewards its captors this time with a very thin shell."

London University Roof.—As a proof of the different views of different architects with regard to the strength of materials, we cannot cite more forcible examples than those exhibited in the roof of the late Brunswick Theatre, and that of the new London University. Though we have no wish to eulogize one architect at the expense of another, we believe scarcely any person, at all acquainted with the strength of building materials, would have considered the horizontal scantling of such an immense iron roof as that of the late Theatre, 117 feet by 63, sufficient to guarantee the perfect safety of the building; while the iron ties, or girders, which connect the walls of the new University, are strong enough to sustain a roof of at least four times the estimated weight. The principle on which these horizontal girders are constructed,—that of a rib, or rafter, with a pediment elevation,—we think very beautiful; while every risk of fracture from sinking, or from the lateral pressure, is provided against by a wrought iron bolt (forming, as it were, the chord of the arc) running from end to end, and secured by nuts and flanges in the usual way.—*Verulam.*

Another Coal Mine Explosion.—On the 27th of March last, an explosion of foul air took place in a coal mine at Seraing, in Belgium, by which forty-seven miners lost their lives. The explosion was heard at the distance of half a league, and

the column of flame from the mine rose through the air-shaft eight or ten feet.

Setting Watches.—The common notion that the going of a watch is injured by setting the minute hand *backward*, is pronounced by Mr. Reid, in his excellent Treatise on Horology, to be founded in error. It is only necessary, he says, in the case of *repeating* watches, to wait till each hour is repeated after each revolution of the hand, so that all the pieces of the machinery may take their natural situations. In common watches, no precaution whatever is necessary.

Oil and Coal Gas.—Mr. Brande, who took some time ago so conspicuous a part in behalf of oil gas (with no great advantage, it must be confessed, to his reputation), still persists, it appears, in affirming that "purified coal gas rarely contains more than 40 per cent. of carburetted hydrogen, or olefiant gas; whereas oil gas affords, generally, about 75 per cent.—*thus showing its superiority*." (See Report of his Lectures at the Royal Institution, "Lancet," No. 231.) After all that has passed on the subject, this is rather unfair in Mr. Brande. It has been incontestibly proved (1827), as Mr. Brande is well aware, before different Committees of the House of Commons, that though the usual produce of oil gas is about 75 per cent., yet, that in its passage through the pipes, the deposition which takes place is so great as to reduce that quantity to about fifty-five cubic feet; and that when oil gas is charged 50*s*. per 1000 cubic feet (it cannot be furnished at a profit for less), and coal gas at 15*s*. (the usual charge), the oil gas is three times dearer than coal gas. A more decisive proof of the real *inferiority* of oil to coal gas, as an economical means of lighting, could not be adduced, than the fact that the Edinburgh Oil Gas Company, after losing nearly £60,000 (on the authority of Mr. Brande chiefly), have now an application before Parliament, for leave to convert their Oil Gas Works into Works for the manufacture of Coal Gas.—X. X.

Thermometric Beads.—Mr. Prinsep, Assay Master of the Mint at Benares, has prepared a new method of ascertaining high temperatures, founded on the general fact that every substance has its fixed point of fusion. He makes the fusing points of silver, gold, and platinum, serve as the three grand divisions of a scale, and finds as many intermediate degrees as are required, by alloying these three metals together in different proportions. The fusing point of silver is the zero of his scale; and for the difference between that and the fusing point of gold he appropriates 10°,—obtaining measures of each degree by a successive addition of ten per cent. of gold to the silver. For the distance between the fusing point of gold, and that of platinum—the most difficultly fusible of all metals—he allows 100°, adding to the alloy which is to denote each degree in succession, one per cent. of platinum. It will be readily perceived, that when such a series of alloys has been once prepared, the heat of any furnace may be expressed by the alloy of least fusibility which it is capable of melting. The determinations afforded by a pyrometric collection of this description will, independently of their precision, have the advantage of being identifiable at all times, and in all countries. The smallness of the requisite apparatus will be an additional recommendation—consisting, as it does, merely of a small box, containing, in separate cells, the necessary number of pyrometric alloys, each of the size of a pin's head.

Formation of Haloes.—The following experiment, which illustrates in a striking manner the formation of those celestial appearances called *haloes*, is given by Dr. Brewster:—Sprinkle a few drops of a saturated solution of alum over a plate of glass, when they will rapidly crystallize in small flat octohedrons, scarcely visible to the eye. Hold this plate between you and the sun, or a candle, with your eye very close to the smooth side of the glass plate, and you will see three beautiful haloes of light, at different distances from the luminous body. The innermost halo, which is the whitest, is formed by the images refracted by a pair of faces of the octohedral crystals, not much inclined to each other. The second halo, which is more beautifully coloured, with the blue rays outwards, is formed by a pair of faces more inclined; and the third, which is very large and highly coloured, is formed by a still more inclined pair of faces. Each separate crystal forms three images of the luminous body, placed at points 120° distant from each other in all the three haloes; and as the numerous small crystals have their refracting faces turned in every possible direction, the whole circumference of the haloes is completely filled up. These effects may be curiously varied, by producing, on the same plate of glass, crystals of a decided colour; by which means you may have white and coloured haloes succeeding each other.

NEW PATENTS.

David Bentley, of Pendleton, Bleacher, for an improved method of bleaching and finishing linen or cotton yarn and goods.—21 February—6 months.

William Brunton, civil engineer, Leadenhall-street, for certain improvements in furnaces for the calcination, sublimation, or evaporation, of ores, metals, and other substances.—21 February—2 months.

John Levers, of Nottingham, machine-maker, for improved machinery for the manufacture of bobbin-net lace.—3 March—4 months.

William Poronall, of Manchester, weaver, for improvements in making healds for weaving purposes.—6 March—4 months.

B. H. Brook, of Huddersfield, civil engineer, for improved ovens and retorts for carbonizing coal for the use of gas works.—6 March—6 months.

NOTICES TO CORRESPONDENTS.

Subscribers, in possession of incomplete sets, are informed that a small stock of odd Numbers is still on hand, out of which they may probably be supplied with what they want at the original price.

Several Papers in type for this Number, have, in the making up, been unavoidably left out for want of room.

We propose inserting the Series of Papers by Δ, as soon as those on Fluxions are concluded.

Our ingenious correspondent "S. Y., a Young Engineer," informs us he is in want of employment as Superintendent of a Manufactory.—Should we hear of any thing of the kind, we will let him know.

Communications received from Mr. Phepoe—Mr. Spence—H. H.—Philo-Naut.—R. Gooch—R. R. M.—Mr. Brown—E. S. L.—F.—W. F.—A Son of a London Watchmaker—An Ex-Leicestershire Farmer and Grazier—Benevolus—J. S. Beckford.

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MESSRS. JONES AND CO.'S PATENT IRON WHEELS.

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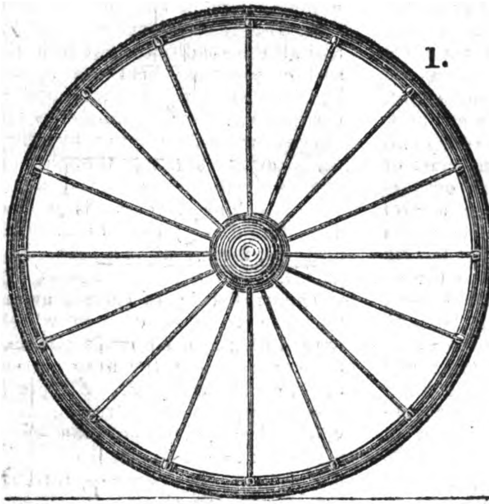

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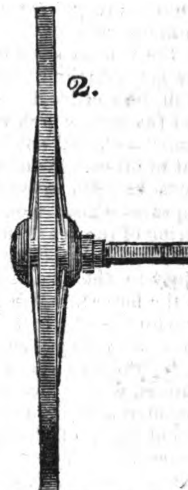

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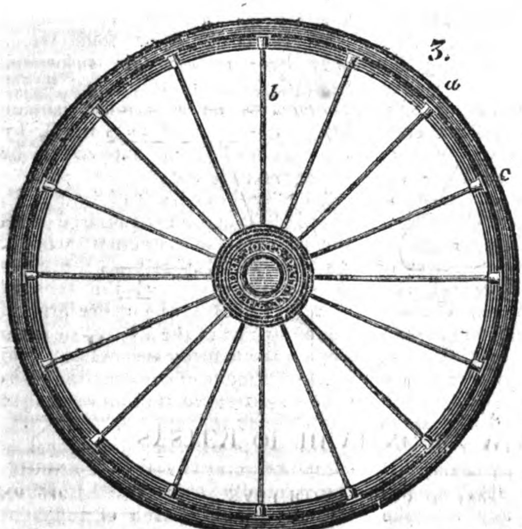

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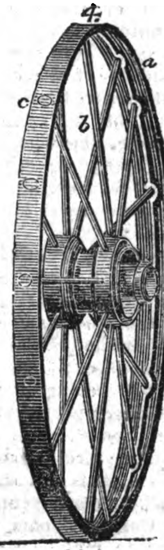

MESSRS. JONES AND CO.'S PATENT IRON WHEELS.

It is well known, to all who have paid any attention to the construction of carriage wheels, that two of the improvements now in greatest request are, *first*, that they shall be so made, as that the whole breadth of the wheels shall bear equally on the ground; and, *second*, that they shall be constructed of some material (as iron) which will wear better than wood, and not be so frequently out of order. Among the most obvious benefits consequent on these improvements, would be a great saving of the roads, a great saving of animal labour (since the less the injury to the road the less the toil to the horse), and a great saving in coachmakers' and wheelwrights' bills. So very serious, indeed, is the injury done to roads by the conical rimmed wheel, now generally in use, considered to be, that by one of the recent Acts of Parliament for the General Regulation of the Turnpike Roads (3 Geo. IV. c. 126, s. 9), it is specially enacted, "That where any waggon or cart shall have the sole or bottom of the wheels thereof rolling on a flat surface, and the nails of the tire of such wheels countersunk and cylindrical, that is to say, of the same diameter on the inside next the carriage as on the outside, so that when such wheels shall be rolling on a flat or level surface, the whole breadth thereof shall bear equally on such flat or level surface, and shall have the opposite ends of the axletrees of such waggon, cart, or other carriage, so far as the same shall be inserted into the respective naves of the wheels thereof, horizontal, and in the continuance of one straight line, without forming any angle with each other; and in each pair of wheels belonging to such carriage, the lower parts, when resting upon the ground, shall be at the same distance from each other as the upper parts of such wheels;" it shall be competent to the Trustees or Commissioners of any turnpike road to make an order, that every such waggon or cart shall pay *one third less toll* than carts or waggons constructed on the old plan.

We have now the pleasure of introducing to the notice of our readers and of the public, a mode of constructing wheels, by which, in our humble opinion, *both* of the *desiderata* above mentioned are realized, and all the conditions that form the sort of premium held out by the legislature for the improvement of carriage wheels are completely fulfilled;—not only so, but by which many other valuable, though perhaps subordinate, advantages are gained. The inventor is a Mr. Theodore Jones; to whom, and his partners, the invention is secured by patent.

The reader is, of course, aware that the common wooden wheels have hitherto been made so that the spokes under the nave sustain the weight, or load. All previous attempts at constructing iron wheels proceeded upon the same principle: in consequence of which the iron spokes have invariably yielded to the shocks or concussions received in rapid motion, and broken short off either at the nave or the outer circumference. Now, according to the plan of Mr. Jones, the wheels are so constructed, that the weight or load which they have to carry is suspended from that part of the wheel which happens to be uppermost, instead of being supported, as is usual, by the spokes which happen to be under the axletree.

The spokes consist of iron rods, of small diameter compared with the spokes of common wheels. As the wheel revolves, the nave does not press upon the rods at all; it is held to the upper arch of the outer rim of the wheel, so as to sustain the load by suspension: and while this mode of construction gives excessive strength, it produces a light and elegant appearance.

The parts of which the wheel is composed may be thus more circumstantially enumerated. First, there is a rim of iron of sufficient substance; the weight or load is

held in the centre by a nave and box of iron, containing hollow cells; iron rods are passed through the rim, and into the nave, where they are held by means of a nut, but with end play; the rods having no shoulder whereon the nave can rest, suspend the weight from the top of the rim, or outer circumference, of the wheel; each rod varying, according to the intended wheel, from half an inch to an inch in diameter, would carry from 5 to 25 tons, and the arch-like circumference is held in that form, by the rods passing through. It will be obvious that the parts cannot separate, or fall asunder, for the rods fix and bind the circumference to the centre; and no blow or concussion in travelling can shake or alter it. The effect of the most violent shock is only to force the rod slightly into the nave for an instant of time; the wheel revolving, brings its suspensive power into play, and restores its strongest form of application. The wear of the common wheel tends to its falling asunder; but as Mr. Jones's wheel is held from the circumference to the centre, every movement tends to compress and fix it more firmly together.

The construction will be made more apparent by a reference to the accompanying figures.

Fig. 1 represents a side elevation of a wheel for gigs, or other light carriages.

Fig. 2 is another view of the same.

Fig. 3 represents a cart or waggon wheel.

Fig. 4 is a perspective view of the same. *a* is a strong rim of iron, which may be either a plain hoop, or made with a rib on the inside, as shown, to give it additional strength. There are 16 conical holes made through the rim, at equal distances.

Fig. 5 is a view of one division of the nave on a larger scale, with the front plate or shield taken off, the better to show its construction. It contains 8 cells or compartments.

Fig. 3, *b*, represents a suspending iron rod, made with a conical head, which exactly fits a conical hole in the rim; the other end of the rod is formed into a screw. The rod is passed through the hole in the rim at *c*, and through a corresponding hole in the nave, till the screw end of the rod enters the cell; when a nut is screwed on it, as shown in fig. 5. Each of the rods is placed in the same way alternately, in the front and back nave. A plate or shield is then fastened on to each nave, as shown in fig. 6, *e e*, which fits against the flat sides of the nuts, and effectually secures them from unscrewing.

Fig. 6 is a section of the nave and box. *m* is the chamber for holding oil, with a screw to allow the oil to be poured in, without taking the wheel off the axle.

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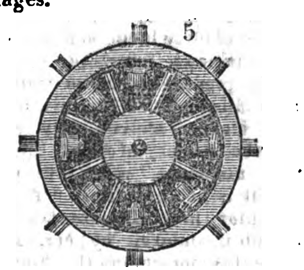

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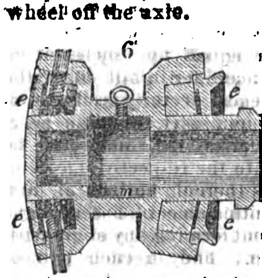


By the preceding arrangements, the most durable material at present known is made available, simply by allowing end play; so that when any part of the outer circumference of the wheel receives any jar, shock, concussion, or jolt, the rod is allowed to retire, however slightly, yet enough to relieve the sudden pressure upon that part of the wheel.

We subjoin a statement of the principal advantages which Mr. Jones claims for his patent iron wheel; and, having ourselves personally examined its construction, have no hesitation in adding our in-

dividual testimony, that he claims no more merit for it than it actually possesses. In one respect, indeed, —the superseding entirely of linch-pins or screws,—we think he understates the advantage of the new wheel considerably. We can imagine nothing more perfect than the arrangement for this purpose, or more satisfactory than the security it affords.

"1. Greatly increased durability, from being made wholly of iron, and consequent cheapness, as the first cost differs but little from the common wheels.

"2. Being perfectly cylindrical, the wear of the tires, as well as of the roads, is much reduced. The wheels roll over, and do not grind upon, the surface of the road.

"3. From this form, also, results a diminished draught for the horses.

"4. Every part of the wheel is easily repaired.

"5. The mode of oiling is extremely simple, and is only necessary twice or thrice in a year, and is then effected without taking the wheels off the axle; whereas the common wheels have to be taken off the axle, and greased once a week. This is a constant saving, and will be highly beneficial in practice.

"6. The axles for waggons and carts are at liberty to revolve, and the wheels are secured to them without linch pins or screws; so that it is scarcely possible they should come off by any accident whatever: and for lighter carriages, the safety and security in that particular is as nearly complete as, it may be presumed, can ever be effected.

"7. Being made entirely of iron, they are not subject to decay and destruction from change of weather or climate. They neither expand in a wet season, nor shrink in a dry one; and in the most unfavourable climate no insect can do them injury.

"8. They may be made of any conceivable strength, so as to endure heavier work than any other wheels whatever.

"9. They are of value when done with, as iron; whereas, wooden wheels, when worn out, are worth very little.

"10. When the eye becomes familiarized to their light and elegant appearance, the common wheels, when contrasted, must appear heavy and clumsy.

"11. Increased safety; for, as they stand on a wider base, there is much less liability that the carriage should be overturned.

"12. Gig wheels are found, on comparison, to run more quietly."

Several carts and waggons, with wheels constructed on this plan, have, we understand, been in use for some months past, in and about the metropolis, and have, *without exception*, realized all the advantages which they promised. The manufactory of the patentees is situated at Vauxhall, close by the Bridge.

ON FIRE-ESCAPES.

Sir,—From the melancholy loss of human life by fire, during the two past months, the subject of fire-escapes has occupied a considerable share of public attention; and as this subject is at all times one of vital importance, I hope the following observations will be considered worthy of a place in the pages of the "Mechanics' Magazine," in which this subject has already been taken up.

The first fire-escape which I shall notice is one by Mr. J. Davis, consisting of three ladders, &c., mounted on a carriage, something similar to one at present known as "Gregory's Fire-Escape." For this machine Mr. Davis received fifty guineas from the Society of Arts. (See their "Transactions," vol. xxviii. p. 175.)

The next in order is "A Speedy Elevator and Fire-escape," of a complex nature, by Mr. Thomas Roberts; for which the Society of Arts, &c. awarded him their silver medal and twenty-five guineas. (See "Transactions," vol. xxxi. p. 155.)

In the same volume, p. 244, is also a fire-escape by Mr. A. Young; for which he received a silver medal and five guineas. This escape consisted of a ladder, the two sides of which

were made of ropes; the steps were of wood, having a ferrule or socket at one end, the other end being turned smaller to fit into the socket of the step below it: the steps thus fitting into one another formed a long pole, at the top of which was a large two-pronged hook, to take hold of the window-sill. This escape packed up into a very small compass, and was extremely light and portable. In case of fire, this machine being brought to the scene of danger, the steps were to be joined together until sufficiently long to reach the window from whence any person was to escape. The hooks having taken firm hold, the steps were to be pulled downward, when they would part, forming a convenient ladder.

The next fire-escape is one by Mr. Brady; for which he received the silver medal of the Society. (See "Transactions," vol. xxxiv. p. 227.) See also vol. xxxix. p. 150, of the same work, for a most excellent fire-escape by Mr. G. A. Witty, which forms an elegant and convenient article of furniture, viz. a sofa, or easy chair; the natural position of which would be the recess of a window in a bed-chamber—the precise place where, in case of danger, it would be most conveniently used. Mr. Witty states, that by means of this instrument a person may descend from a four-story window into the street, in half a minute from the time of getting out of bed. Ten guineas was voted to Mr. Witty for this invention.

Gregory's fire-escape, consisting of several ladders mounted on a carriage, and raised by pulleys, &c. &c. is an ingenious contrivance, but is not sufficiently portable to be of any extensive service; it also requires considerable practice to manage it properly;—several parishes are, however, provided with them.

Another fire-escape is that of the Rev. I. Cobbin; for a description of which I refer your readers to vol. i. of the "London Mechanics' Register." See also a fire-escape by Mr. J. Barnard, in vol. vii. of the "Mechanics' Magazine," p. 208.

Of these several benevolent attempts to save the lives of their fellow-creatures, for private use, that of Mr. Witty is decidedly the best; and of those which are calculated to afford external aid, I must prefer that of Mr. Young.

Nearly all the houses of modern erection have an opening in the roof; or if not, are furnished with attic windows, having a parapet before them, along which any person may escape to the adjoining house. The inhabitants of such buildings as have not one or other of these advantages, should provide themselves with fire-escapes, and not trust to the arrival of any external aid.

Much diversity of opinion exists as to the propriety of keeping the fire-ladders under lock and key; for my own part, I disapprove of it. No person could remove a two or three-story ladder, either by night or day, unperceived. For one instance, among many, of the disadvantages attending the lock and key system, let us take the melancholy catastrophe at Crutched Friars, a short time since, where five persons were burnt to death in the presence of a large body of watchmen and firemen, who, could they have obtained the fire-ladders of St. Olave's parish *(kept within a stone's throw of the fire)*, would, no doubt, have saved the greater part, if not the whole, of these unfortunate individuals from their untimely end. It behoves every individual to take a personal interest in the ladders and fire-extinguishing machinery belonging to his parish; to see that they are in proper order, and brought out with promptitude; not knowing how soon he may himself require their aid. Sorry I am to say, that in several parishes *within the walls* these particulars are most shamefully neglected; and I hope this hint will be duly appreciated by those to whom it most forcibly applies.

Few persons are aware how trifling a thing will break the force of a fall. A blanket, or even a fireman's or watchman's coat, held out for persons to jump into, would, in nine cases out of ten, preserve them from injury.

Mr. Buxton, when a youth, fell

from the upper story of a high house, in Eastcheap; falling, however, on a clothes-line (which he broke), he was taken up unhurt; he has, therefore, proposed, as a fire-escape, a large sheet of canvas, strengthened with netting on the under side, and having strong loops all round the edge for the convenience of holding. Into this sheet, held breast high by six or eight persons, any one might jump from a high window without receiving any injury.

Mr. Buston proposes, that one watchman in every street should be provided with one of these escapes. From their extreme simplicity and portability, and more especially from being in the hands of persons on the spot where they might be wanted, they would furnish, if not a pleasant, yet certainly a sure and safe, escape; long before any other assistance could be procured.

To breaking through the party-wall, as proposed by your correspondent "J. S. S." at p. 67 of the present Volume, there are many serious objections. In the first place, supposing a person might be able to break through the party-wall, under ordinary circumstances, in five minutes (which all the firemen I have consulted deny), yet, in the event of a fire, from the absence of all presence of mind, and in the confusion of the moment, I doubt if it could be accomplished in *five-and-twenty* minutes!

In less than five minutes, under proper management, ladders or other means of escape would be obtained. Few persons in an adjoining house would be willing to attempt such a desperate method of rescuing his neighbour. No firemen ever would; for it must be remembered, that on the substantiality of the party-walls, the safety of the adjoining houses almost always wholly depends. The idea "of filling up the hole instantly with the bricks taken out," is entirely fallacious. The greater part of the bricks would be broken to pieces; but, if they were not, when loosely put in again, they would afford no security; for I have myself known instances of party-walls (even unbroken) having been insufficient to resist the penetrating influence of the calorific particles.

Again, supposing a person's premises to be burnt down, he having cut through the party-wall to save the life of a person in the adjoining house, in which we suppose the fire to have originated,—could that person, I say, make good his claim on the insurance office, who had so far committed himself as to break down the barrier, on the *existence of which the very rate of his insurance was calculated*.

Of all the fire-escapes offered to the public, few possess so many advantages as a good strong rope, made fast to the bed-post.* It is the cheapest and the most simple, occupies but little room, and is always ready at a moment's notice; nor is it likely to become deranged or out of order.

In the hands of an active and attentive engineer, perhaps the fire-ladders are equal, if not superior, to any other fire-escape: in other hands, a fire-escape, of any kind whatever, is totally useless. The most generally useful implement, at the commencement of a fire, is a good crow-bar, with which every engine is, or should be, provided: to this may be added the fire-axes, plenty of which are always in the hands of the firemen.

I am sorry to observe that the method proposed by "P.," in No. 237, is totally impracticable. For, to be effectual, the parachute must be exceedingly large, and very strong, consequently very heavy and unwieldy; in the next place, the person using it would not be able to project himself far enough from the front of the house, to give the parachute room to right itself, and the distance fallen would be so trifling, that the person would reach the ground before the retarding power of the machine could be brought into effectual action. If a safe descent *could* be effected by this means, very few men would have sufficient confidence in the power of a parachute to avail themselves of it, to

* Which may be improved by knotting it. (See "Mech. Mag." vol. i. p. 32.)

say nothing of women and children. Of the proposal of Mr. Hudson, in the same Number, I entertain a very different opinion, and I hope his admirable suggestion will not be lost sight of. Having extended this communication to an unusual length, I take my leave, for the present, of the subject, and remain,

Your obedient Servant,

W. BADDELEY, JUN.

March 11, 1828.

10, *George-yard, Lombard-street.*

MR. JOPLING'S SEPTENARY SYSTEM—FURTHER ILLUSTRATIONS.

Sir,—Having given you a description of *one division of the Septenary System*, and one example of what I have denominated *cases of gradual remission*, I beg now to call the attention of your readers to *three cases of harmony*.

In imitation of Mr. Addison, I have, in No. 211, p. 118, shown the application of facts, illustrated by the Septenary System, in our speculations of our *Creator* and ourselves, and on Eternity and Time. And, although my present object is to describe *three cases of harmony*, I may, perhaps, also be allowed to point out their application to illustrate the doctrine of *One God in Trinity, and Trinity in Unity.*

Most deeply regretting my inability to express myself in language befitting such a subject, your readers will, I trust, pardon me for making the attempt, if I should not, in the most distinct and appropriate manner, describe my ideas.

Previously to entering upon the immediate object of the present letter, I shall just advert to the comparison of *Eternity* and *Time* with those infinite lines of which only a middle portion can be produced.

Since my paper above alluded to appeared in your work, a writer in another periodical work has attempted to show that the kind of reasoning used by Mr. Addison, in speculations of Eternity, is not correct.

This writer says,—"It is extremely difficult to divest ourselves of the tendency to think of finites when we are reasoning about infinites. We may speak of duration before time and duration after time; that is, before and after that portion of it which is measured and divided into equal parts: but the metaphysical terms invented by the schools, *eternitas a parte ante*, and *eternitas a parte post*, are absurdities. It is dividing eternity into two parts, or rather making two eternities. Eternity is duration without beginning and without ending, and time is a certain measured portion of it. Eternity may be feebly represented to the mind by the idea we have of the circumference of a circle, in which there is neither beginning nor ending. By taking from the circumference of a circle, say an inch, and dividing it into a hundred parts, you do not divide the remainder into two parts; so neither does time divide eternity into two parts,—that *a parte ante*, and that *a parte post*."

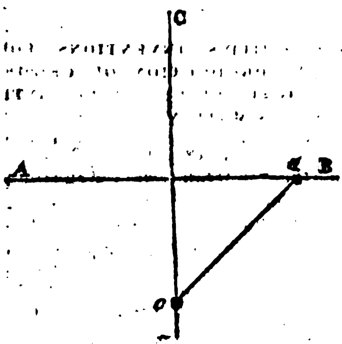
Now, I think it will appear that the whole of this writer's argument is founded in his having selected the circle (not an infinite circle, but a line returning into itself) with which to compare eternity. While he is sensible of the difficulty of divesting ourselves of the tendency to think of finites when we are reasoning about infinites, he falls into the same error himself. It would, in my humble opinion, have been much better had he selected a line that could never return into itself, however far produced; in fact, an *infinite line*. Indeed, it is impossible that even the circumference of an infinite circle (a portion of which may be represented by a right line) could ever return into itself. A portion of such a line being drawn, it may be conceived to be extended to an infinite distance to the right and to the left (the line thus conceived is not *two* but one); and both these distances being infinite, are equal: then, as any portion that can be produced, compared with infinity, is as nothing, therefore, that which is produced divides the whole line into two equal parts.

Returning from this digression,

I beg now to proceed with the subject which was first announced.

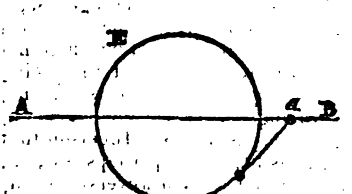
To regulate the motion of a surface exactly in the same way, by means *equally* simple, I am not aware that, in any variety of motion, more than *three* cases of harmony occur. The three cases that I have *selected* for this communication, I shall explain by references to the accompanying figures.

Fig. 1. By this figure the motion



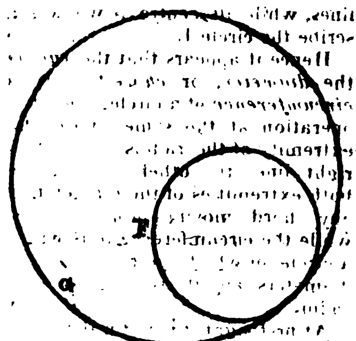
of a surface is supposed to be regulated by its being attached to the right line *a c*; *a* moving along the right line A B, and *c* moving along the right line C D; the right lines A B and C D being each twice the length of *a c*.

Fig. 2. The surface, in this case, is



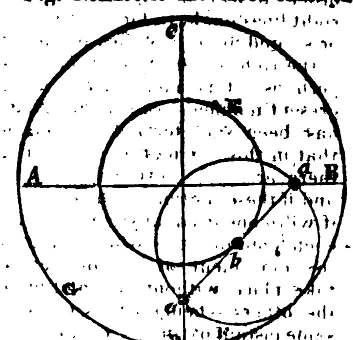
supposed to be attached to the line *a b*; *a* moving along the right line A B, which is equal to the right line A B, Fig. 1, and *b* moving in the circular line E. The radius of the circle E is equal to the right line *a b*; and the right line A B is four times the radius, and passes through the centre of the circle, from which it is equally extended both ways.

Fig. 3. Here, the surface is sup-



posed to be regulated by the circle F rolling against the circle G. The diameter of F is equal to the diameter of E, fig. 2; and the diameter of G is equal to either of the right lines A B in the preceding figures.

Fig. 4 exhibits the three cases in



union. The same letters refer to the several figures in which they occur. The centre *b* of the line *a c* describes the circle E, while the point *a* moves along the right line A B, and the point *c* along the right line C D.

Now, if the circle F be attached to the line *a c* as its diameter, while the points *a* and *c* are regulated by the two right lines, or the points *a* and *b* by one right line and the circular line E, all the parts of its circumference would touch the circle G: therefore, if the circle G be substituted for the right lines A B and C D, and the circular line E, the circular line F being rolled against

it, the two extremities *a c* of its diameter would describe the right lines, while its centre *b* would describe the circle E.

Hence it appears that the *radius*, the *diameter*, or *chord*,* and the *circumference* of a circle, are all in operation at the same time. One extremity of the radius moving in a right line, the other in a circle; both extremities of the diameter, or any chord, moving in right lines; while the circumference rolls within a circle, of which the right lines are diameters, and its own diameter the radius.

At first sight, the natural order of considering these three cases appeared to be that in which the figures are arranged; namely, two right lines, right line and circle, and two circles. But in the last paragraph, by placing the *radius* before the *diameter*, which seems the natural order, it will appear that the two right lines ought to form the middle, or second figure. Which of the two is the right order of arrangement is, perhaps, of no consequence at the present moment; sufficient probably has been said to make it obvious that in this *one* motion of a surface there are three distinct principles; and if these motions be investigated, it will appear equally manifest that each contains the whole; that is, the movement of the one cannot take place without the motions of the others,—being produced at the same instant of time,—and the effects of the motions of each are precisely the same.

Many passages of Scripture, I think, might be quoted, to show that the *Unity* and operations of the *Trinity* may, with as much propriety, be compared to such cases of *harmony*, as some of those analogies brought forward by writers on *theology*; and, if so, it will perhaps add one to the number of arguments to assist our notions of that incomprehensible subject.

I am, Sir, Yours, &c.

JOSEPH JOPLING.

P.S. The above three cases of motion, so far as that, by each, the ellipse, &c. may be produced, are known to mathematicians; but I have never seen them brought together in one view, in order to point out their complete harmony of operation in regulating the motion of a surface: neither have I ever seen the 2d figure pointed out as being the reverse of the principles of generating the cardioid of M. Carré, which is given No. 231, p. 435.

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* If any chord less than the diameter be taken, the right lines in fig. 1 will not be at right angles to each other. (See No. 220, p. 261.)

MR. CHILD'S INVENTIONS FOR THE PRODUCTION OF GEOMETRICAL FIGURES BY CONTINUOUS MOTION.

Sir,—I have perused No. 225 of the "Mechanics' Magazine," and feel much obliged for the trouble and expense you have been at in devoting a whole page of that valuable publication to an engraving from my specimens. I know, Sir, that out of a numerous assortment it was necessary that you should select the most simple figures for the engraver; and it so happens that this selection contains only two distinct in principle.

I have already sent you such specimens as prove that my model possesses the power of equalizing the motion of a point in the periphery of an ellipsis, and of producing the figures alluded to in page 383, vol. viii. However, the enclosed, drawn when the instrument was first made, may enable you to set this point at rest, without the *expense* of an engraving.*

I do assure Mr. Ibbetson that I feel as little, and perhaps less, inclination for a "controversy" than he does; nor am I conscious of any disposition for "depreciating" his invention, respecting which I have neither character nor interest at stake: but I saw, when his specimens appeared, that the chuck was constructed on the same principle as

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* Having transmitted these specimens to Mr. Jopling, for his inspection, he has favoured us with a classification and description of them, to which we beg to refer our readers. (See p. 219.)—Ed.

my model, respecting which I had previously addressed you *twice*, and felt myself at liberty to *assert* a fact. I would point out, for imitation, the top or bottom corner figure, on the right-hand side of the plate,—but not by way of challenge. My communications to you were made with a friendly disposition both to Mr. I. and the improvement of the *art;* and if he cannot produce figures on the principle of the two before pointed out, and think it worth his attention, I will gladly give him the best information I can; and would have him to know that this disposition was the cause of an assortment of my specimens being clandestinely conveyed to New York, in America, more than twenty years ago; and also, that only three years since, a gentleman took charge of a packet of them, addressed to you, and proposed delivering it at the office of the publishers; but no acknowledgment of the receipt appearing, inquiry was made what he had done with it. His answer was, that he had put it into a post-office, but paid no postage. These specimens, of course, would also fall into the hands of some person or other.

I am much obliged to Mr. Jopling; and, were it in my power, would much rather assist than oppose him. I was well aware of the correctness of his observation respecting parallel ellipses, and used the term in contradistinction only to such concentric ellipses as might have their peripheries intersecting each other. It appears necessary here to repeat some things which have been stated to you before. Each of the specimens I have sent to you is but *one continuous line*; and all of them were produced by the same model—the power of which appears unlimited, in respect to variety in the figures. It consists of toothed wheels, and other parts adapted thereto. I have other instruments, for drawing ellipses, the parabola, hyperbola, &c., composed entirely of metal, and made above forty years since, by me (a self-taught boy, not fifteen years old). I had never seen a description of an instrument for any such purpose, nor have yet seen any instrument, but of my own making, for drawing any curved line whatever, the circle excepted.

From this statement some idea may be formed of the imperfection of the workmanship, as well as of the originality of their construction.

With an ardent wish for the prosperity of your useful work, and my warmest thanks for the attention you have bestowed upon my juvenile *hobby-horse*, I bid adieu.

> "The young may combat, and the laurel claim;
> But age looks on, and will not fight for fame."

I am, Sir,
Yours, respectfully,
K. CHILD.

Shaw-lane, Jan. 12, 1828.

P. S. In the year 1790, I showed my model to James Bolton, of Halifax, (a person well skilled in natural history, but not a mechanic). He said, "You might present it to the Royal Society, but not without some trouble, and a little expense; and then, perhaps, they would only call it "a hobby-horse.""

Sir,—It is said, "He that runs away may fight another day." This is not my intention, however, lady-like, I may frame an excuse for multiplying words.

In No. 227 of your Journal, I see that Mr. Jopling *repeats* his observation respecting my specimens being symmetrical. I wish to assure that gentlemen that this is far from being the case. Indeed, such is the power of this model, that any symmetrical figure which it produces, may as easily be produced dis-symmetrical. Of this, two of the enclosed simple figures are a sufficient proof.*

In 1826 I sent you elliptical spirals, and can, when necessary, send you others, with a variation in the curvature, as the accompanying circular ones have. The model produces spirals, circular or elliptical, to the right or left, and of different

* See Mr. Jopling's communication next page.—EDIT.

sizes, in one *uninterrupted line*, with any required variation in the curvature, and with as much facility as a pair of compasses will draw a circle. The method of doing this is so very simple, that I can scarcely suppose the ancients to have been unacquainted with it; and am therefore inclined to think that this may prove to be the *true Ionic volute*; for the general character of the curve is still the same, be the variation of the curvature whatever it may.

Mr. Jopling's method of drawing a volute, as far as I am able to judge from what he has said, is similar to a mode of drawing volutes with an elliptical *instrument reversed*; respecting which I before wrote to him. I beg to observe, that in Mr. Jopling's communication there is nothing respecting my inquiry about trammel centres.

You know, Mr. Editor, that instruments of this kind require to be made mathematically correct: mine are not so; and for this reason I have called them models. At my age—and, considering the short time I was in the pursuit of these amusements, the number of years that have elapsed since I declined it—any attempt to describe them might only serve to show the difficulty of the undertaking; and yet I might be able to give some necessary information respecting the mode of using them, to any one not having before seen them.

Through the medium of your pages, about a year since, I offered to submit them to the inspection of any member of a Society for the improvement of the arts, or to any amateur likely to judge of such instruments; and am still ready to do so, should any such person think them worth attention.

I entertain neither hopes nor fears respecting the result; for be this what it may, I must attribute the whole to the publication of the "Mechanics' Magazine." Had not that useful work come into my hands, these models might never have been noticed again by me, or, perhaps, by any other person, except as old metal.

I acknowledge that of late I have been anxious to know what scientific gentlemen might say respecting the difficulty of describing volutes; and have reserved the above information for this very reason.

Should these things prove useful, or entertaining to any person, the only remuneration I expect is that they may revive a small portion of the mental gratification I experienced in the pursuit of solitary amusement.

I am, Sir, &c.

K. CHILD.

Shaw-lane, Halifax, Feb. 8, 1828.

Sir,—In reply to your favour, accompanying fifty-two specimens of curves, with two letters from Mr. Child, and one from a Mr. Alexander,* agreeably to your request I offer a few observations thereon.

I trust I have no desire to undervalue the ingenuity of Mr. Child, or of any other person; and any remarks I have made, or now offer, must not be taken in that light.

Mr. C. unquestionably deserves very great credit for what he accomplished, especially at so early an age, and without any knowledge, as he now states, of any previously existing instruments for describing any other curve besides the circle.

The principal difference between the pursuits of Mr. C., as well as those of many other persons, and the path which I have followed, appears to me to be, that theirs have been directed to combinations; while mine have been, almost exclusively, confined to the discovery, arrangement, and investigation, of the effects of *first* principles.

Mr. Child's fifty-two specimens consist of

Two spiral lines; the one cycloidal, and the other, I think, a portion of an epicycloidal line;

Five elliptic formed patterns;

One square formed pattern;

Three triangular ditto ditto;

Nine border or running ditto; and

Thirty-two—the bases of the motion by which they were produced, appearing to have been circular.

The whole of these are, I think,

* The two letters from Mr. C. are those above inserted; that from Mr. Alexander we must defer giving till next week.—EDIT.

either cycloidal, epicycloidal, or formed by combinations of those principles. Some of them contain such a great number of revolutions, that your engraver would find some difficulty to trace them. Such lines show the great power of Mr. C.'s instrument, but rather confuse than illustrate the principles, especially if an inspection of them precede the more simple lines.

In a private letter, which I have written to Mr. C., I stated that I could not, from all that I had then seen, perceive that he had either the principles of my 1st, 2d, or 5th Divisions, in his instrument; and certainly none of the specimens above enumerated have been produced by these principles.

What the principle of Mr. C.'s instrument for drawing hyperbolas, &c. is, I am not certain, although he states it to be the same as the method I have pointed out for drawing a large elliptic arch; but on that principle nothing but an elliptic circle or right line can be drawn. Perhaps Mr. C. has not made the same distinction in principles that I have made.

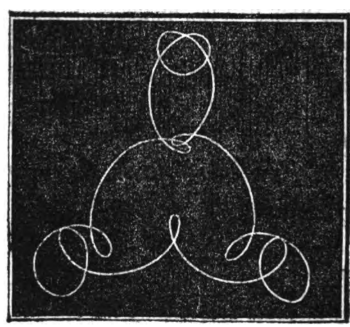
Mr. C. also states that he has attempted to draw volutes with the elliptic trammel reversed; but that he could only produce the spiral of Archimedes; and that half a revolution was only produced at one setting of the instrument: in short, Mr. Alexander says, "that this figure is only such an approximation to the true volute, as a spiral drawn with compasses is to the true spiral." Now, by the reverse of the trammel, I think it is impossible to draw the spiral of Archimedes; and I can assure Mr. C. that the volute that I produced is not formed of such a number, or irregular combination, of parts as in the plan he has tried. The line I form has a *constant* variation of curvature.

The epicycloid spirals have something of the same character as the cardioidal spirals (for the cardioids are epicycloids), and the first attempt I made to draw spirals was by wheels. These, although long subsequent to Mr. Child's, were made in entire ignorance of his or those of any other individual. My reasons for not preferring the methods of producing spirals by wheels are, that I could not make a wheel contract and expand; neither could I produce a spiral line by that means, so that the first revolution should be to the second as the second is to the third, which is very nearly the case in one of the Greek examples. The method I now use overcomes these difficulties.

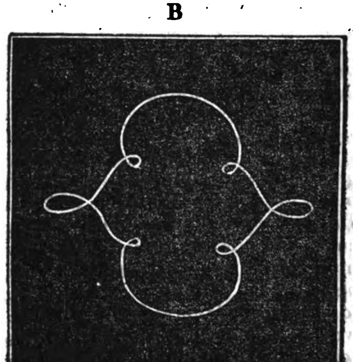
I remember to have seen some square and triangular patterns similar to Mr. Child's. I think they were shown to me by the patentees of a machine for grinding colours; but I do not at present recollect his name: I think it must be about four years ago.

Mr. C., in his letter of the 8th February, alludes to two specimens which he states are not symmetrical. I do not know whether they are those which I have marked A and B; both those I should call respectively symmetrical,—A in two parts, and B in four parts.

A



B



The two specimens of spiral lines are not in themselves symmetrical; but if the winch had been turned the reverse way, and an equal portion in the contrary direction produced, they would then have been in two parts respectively symmetrical.

I beg to refer Mr. C. to No. 227, p. 383, for my answer to his inquiry respecting trammel centres, which he appears to have overlooked.

I am, Sir,
Your obedient Servant,
JOSEPH JOPLING.

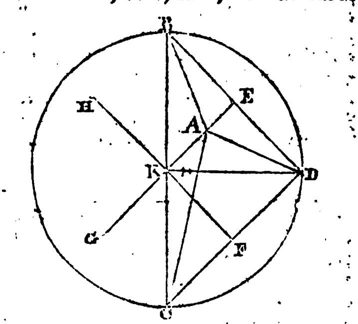
SOLUTIONS OF THE MATHEMATICAL PROBLEM (No. 231, p. 448).

BY G. A. D.

Since the triangle is right-angled, if a circle be described, passing through the three angular points, one of the sides of the triangle will be the diameter of this circle. Since the angle in a semicircle is a right angle, and therefore the centre of the circle will be the point of bisection of this side. The centre of the circle will then determine the side opposite the right angle, and, of course, the equal sides.

Now, to describe a circle passing through the three angular points—

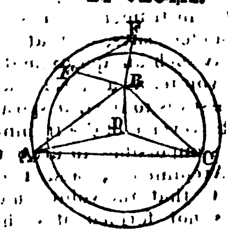
Let A B, A C, A D, be the three



given lines. Join B D, D C, and bisect respectively in E and F. Draw the perpendicular E G, F H, cutting each other in K. (For they must meet, otherwise they would be parallel; and so B D and D C, to which they are perpendicular, would also be parallel, which is contrary to the supposition.) Join B K, D K, and C K. Then, since C F = F D, and F K is common, also the angles at F equal, therefore C K = D K. Similarly, it may be shown that B K = D K = C K.

Hence, with centre K, and radius B K, a circle may be described which will pass through the points B D C. But we have seen that one of the sides of the triangle will be the diameter of the circle; and therefore K is a point in this side, and two of the lines, B K, C K, D K, must be in one and the same straight line. Now, C K and D K cannot be so; for the angles at F being right angles, the angles F K C, F K D, are each of them less than a right angle, and therefore, together, less than two right angles, to which they would be equal, if C K and D K were in the same straight line. Similarly, B K and D K cannot be in one and the same straight line. It remains, then, that B K and C K are in one and the same straight line. Hence B C is a side of the triangle, and the diameter of the circle; therefore, the angle B D C is a right angle, and, consequently, D B C, D C B, are the equal angles of the isosceles triangle, and D B, D C, the equal sides.

BY VECTIS.



Lay down the given distance, from the right angle in any direction, as BD; and, from the centre D, with the other given distances, describe the circles CE, AF. Take a joiner's square, or other instrument of the kind, the extreme parts of which must be graduated into scales of equal parts, numbered from the angle, and from which scale the before-mentioned distances were be taken. Place the angle of

the square on the point B, and keep it there, making the legs revolve till the arcs A and C cut equal divisions on the scales; then will AB, BC, be the equal sides required. For BD, AD, CD, are equal to the given distances by construction; and AB=BC, ABC being a right angle, according to the conditions. EBF is another position of the square, but here the point D is without the angle EBF; and therefore without the triangle EBF.

[Solutions of this problem have been also received from Gulielmus—Mr. Mackinnon—N. J. Andrew—and M. B., jun. We have preferred those now given—the one as the most complete, and the other as the most novel.—EDIT.]

PERPETUAL MOTION.

Sir,—In the "Mechanics' Magazine," (No. 232), the subject of "Perpetual Motion" is again presented to the public. I, therefore, entreat permission to lay before the readers of your truly valuable publication, a few observations on Mr. Baddeley's letter. In the first place, I think, the worthy gentleman has drawn a very unwarrantable conclusion, in asserting that a number of magnets, placed in certain positions at the circumference of a wheel (the rim of which being furnished with slips of magnetized steel), "will cause it to revolve *ad infinitum*." Not to trespass on your valuable space more than is necessary, I shall only observe that, if a magnet be placed with its proper pole, near the circumference of a wheel thus constructed (whether it be situate in a vacuum or not), the magnetic influence will act most powerfully on the piece of steel which is nearest to it; and, as the piece of steel thus attracted, cannot possess the means of transferring the action of the magnet to another piece, the wheel must necessarily remain motionless. Mr. Baddeley will doubtless say (as he has already said), that there must be another magnet placed at another part of the circumference of the wheel, whose opposite pole will repel with as much force as the other attracts; and that these powers acting conjointly (with the assistance of wooden blocks to keep off the attraction from certain parts of the wheel), will occasion it to *revolve "ad infinitum*." Let us see how this will turn out. Will not the repelling magnet act, as the other does, most powerfully on the nearest piece of steel? Yes; and it will drive it away—only until the succeeding piece is brought into contact with the repelling force; when that will be driven from the magnet with equal violence, in a contrary direction. For example: let us suppose the pieces of steel on the rim of the wheel, to be placed two inches asunder, with their north poles pointing towards its centre; their south poles will, of course, stand in an opposite direction; then bring the south pole of the magnet, which is intended to repel, sufficiently near to cause it to act, and it will be found that the nearest piece of steel will be driven one inch forward, or backward: in either case, the force which repels one piece, will cause another to approach in the same ratio; which piece will be repelled with equal force, in an opposite direction; and as the repulsion received by one piece, cannot possibly occasion another to pass the maximum of the magnetic influence, the whole power of the magnet will rest between two pieces; consequently the wheel must remain stationary. It is, therefore, plain, in spite of wooden blocks, that if the powers of attraction and repulsion are equal (in this case), motion is impossible; so also, if one of these powers is greater than the other, the object acted upon will invariably obey the superior power, and that obedience will consist in uniform stillness.

I beg to remain, Sir,
Your obedient Servant,
K. G.

Chalford-hill.

MISCELLANEOUS NOTICES.

Water Purifier.—A sprig of the fragrant shrub called in Ireland *bog* myrtle, when left to steep in a cask of water, is said, in an Irish journal, to have the effect of preserving it sweet and uncorrupted for any length of time.

Wedgewood's Black.—The fine black grey colour of the Wedgwood ware is thus produced. —The porcelain, when baked, and before it is varnished, is put into a clay mould, or a vessel of cementation, that resists fire, and then entirely covered with pulverized charcoal, consisting of one part of animal charcoal, and seven parts of fir charcoal. The mould is then closed with a lid, and exposed to heat for three hours, after which it is set aside to cool. On opening the mould, the porcelain is found perfectly preserved, and of a rich black colour.

Air not always necessary to Animal Existence.—Numerous have been the instances reported of frogs and toads being extracted alive from the heart of blocks of wood and stone; but the evidence has never been so perfect, as to place beyond all doubt the reality of such an occurrence. There have been very respectable philosophers, who have even insisted that there was just as much reason to believe in disentombed living frogs and toads, as in the stories so common in old authors, of lamps being discovered in tombs, which had continued burning for hundreds and thousands of years. Some experiments, however, which have been recently made by Dr. Edwards, of Paris, prove completely that animals of this class can actually live for a long time encased in solid substances, without any access of air. He placed ten frogs, each in the centre of a mass of plaster, enclosed in a thick wooden box; and five others under water. At the expiration of eight hours, the latter were found to be dead; sixteen days after, the boxes were opened, and the frogs discovered to be still alive. Similar results were obtained from several other trials, with salamanders, toads, &c., and with sand instead of plaster. Dr. Edwards found, that although a certain quantity of air entered the boxes and sand, yet that it was by far too little to maintain life.

Late Eruption of Vesuvius.—"There has been an eruption of Vesuvius! It has not been a grand one, but quite enough to give me an idea of its tremendous and destructive power. During the whole of Friday, the 21st of March, immense quantities of smoke, that filled the whole mouth of the crater, which is about three miles in circumference, were sent forth without intermission; and at night the flames issued in the same manner, and were visible to a great height above the crater. At times, the clouds passing over the mountain were made perfectly transparent by the immense flames which issued from the crater beneath them, and the reflection formed a body of light in the heavens that might be compared to the pillar of fire by which the Israelites were led at night through the wilderness. On the morning of Saturday, the 22d, both smoke and flame had nearly subsided, until about two o'clock in the afternoon; when the smoke issued in a larger volume, and rose majestically, curling to a greater height than at any time on the previous day. In the evening we set out, that we might arrive, as night came on, at the summit. We reached the mouth of the crater a little after midnight. During our ascent, we had heard tremendous explosions, which had not taken place the night before, and we had seen, high in the air above our heads, the fragments of fire, which either fell into the crater again, or on the opposite side of the mountain to that we were ascending; and we were now able to look down upon the caldrons of fire from which the explosions proceeded. On the further side were three holes, at a short distance from each other, but connected by a canal flowing with burning lava, whilst fire continually issued from the holes, throwing up lava, cinders, and other substances. At the bottom of the crater, on the side nearest to us, was an immense hole, full of a fiery fluid, like metal in a state of fusion, and bubbling and bursting over the sides; whilst, each time that it rose above the hole, there was a crash and a noise louder than thunder, which could be heard at the distance of many miles. This was accompanied by a discharge of immense pieces of lava, scoria, or hot cinders, and other volcanic substances, thrown to a great height above the crater, and falling, fortunately for us, on the other side of the mountain. The effect was truly sublime."—*Correspondent of the Athenæum.*

Colour of the Human Skin.—The actual seat of colour in the human skin is a very thin layer, not thicker than the cuticle, of a soft substance, which is interposed between the scarf-skin and the cutis, or true skin, and is termed the *rete mucosum*, or mucous net-work. In the negro it is, as may be supposed, of a very dark colour, and the colouring matter is capable of being communicated to water, rendering it turbid, and subsiding in the form of a fine carbonaceous powder. The true skin, and the parts below, are of the same colour, both in whites and blacks. Oxymuriatic acid will render the *rete mucosum* yellow in negroes, and immersion in water will take away much of the colour.—*Conversations on the Animal Economy.*

Walking Vertically.—It was not till Sir Everard Home had an opportunity of examining the *Lacerta Gecko*, a species of lizard which is a native of Gava, that any light was thrown on the property which many animals possess, of attaching themselves to vertical walls, as insects hang on a ceiling. This animal was observed by Sir Joseph Banks, to come out in an evening from the roofs of the houses, and walk up and down, with perfect ease, the smooth hard polished china walls, common in that country, in search of flies, its usual food. On examining the feet, it was found that this animal has five toes, at the end of four of which are sharp claws. At the lower surface of each toe are sixteen transverse slits, leading to as many small cavities or pockets, with fringed edges; and connected with them is a curious structure of muscles, by means of which the edges of the pockets "are turned down, and forcibly kept upon the surface on which the animal stands; while the muscles within, by their action, pull up the pockets and produce a kind of vacuum, which tends to keep the animal from falling. The same plan has been adopted in the formation of the hinder flippers or feet of the walrus or sea-horse, which are made like gigantic webbed hands, and furnished with muscles which can raise up the centre of the hands so as to act like a cupping-glass, and thus prevent the animal from falling backwards, when climbing rocky cliffs or ice-bergs."—*Ibid.*

New Filtering Machine.—A new engine for filtering water has been invented by Messrs. Stirling and Son, which promises to be of great utility. It is composed of slate, for domestic purposes, and the filtration is effected by causing the water to *ascend* through the filtering material, as in Mr. White's invention (described in "Mechanics' Magazine," No. 227). It differs, from the latter, however, in this,—that no use is made of the principle of hydrostatic pressure. The nature of the filtering material is kept secret for the present, till a patent be obtained by the inventors.—*Verulam.*

Hemp from Bean Stalks.—Professor Milling-

ton, in the first of a series of Lectures which he has just commenced at the Royal Institution, on Spinning and Weaving, gave an account of the conversion of common field bean stalks into hemp, or useful fibre, of an excellent quality, and of excessive strength. The stalks are steeped for ten or twelve days in water, and are then combed or heckled.

The Potato.—Although this useful plant was imported by Sir Walter Raleigh, from America, as early as about 1586, it was, for a long time, only cultivated as a curious exotic in the gardens of the nobility and gentry. After nearly a century had elapsed, it was planted out in the fields in small patches, in Lancashire, whence it was gradually propagated all over England. In Scotland it was not grown in the open fields, till 1728, when Thomas Prentice, a day-labourer, first cultivated patatoes at Kilsyth. His success was such, that he made by his potato crops £200; on the interest of which he subsisted for the rest of his life, dying at Edinburgh in 1792, aged 89. Gerard was the first author who gave the potato the scientific name of *solanum tuberosum*, which Linnaeus and his followers have since adopted.

Magnetism is said to be rapidly gaining, or rather *re*-gaining, ground in Paris. One of the most novel features attending its revival is, a notion that no one can be inspired with the magnetic influence, who has not lived at some former period in the world, submitted to the stroke of death, and had his spirit embodied a second time. There is a dreamer of this class, who pretends that he figured at the siege of Troy, and was the friend of Achilles!!!

Expedition to the South Pole.—The Chanticleer, commanded by Captain Forster, who accompanied Captain Parry in his last voyage, is to sail from England, in the course of a few days, for Madeira, whence she is to proceed to various points in the West Indies, and down the coast of South America to Cape Horn. Her extreme destination is the recently discovered group of the South Shetland Islands, and the principal object of the voyage is to make experiments on the swinging of the pendulum at different points of the ship's course (that, combined with other experiments which have already been made in different parts, a correct deduction may be made from them, of the figure of the earth, variation of gravity, &c.); but it is stated, that conditional instructions have been given to Captain Forster, to proceed from the South Shetland Islands, as far as he can, without risk to his ship, towards the South Pole, where, judging from the account of Weddell, he is not likely to experience those obstructions which rendered the attempt of Parry to reach the North Pole abortive. The officers who accompany Captain Forster have all been selected on account of their scientific acquirements. The duration of the expedition is, we understand, limited to three years.

Phenomena of Volcanoes.—A curious paper on this subject, by Sir Humphrey Davy, was read before the Royal Society on the 20th of last month. The object of it was to show that the metals of the alkalies and earths, might exist in the interior of the globe (subterranean cavities), in situations, &c. in which water and air might have access; and that the action of the latter upon them might give rise to volcanic fires, and to the production of lavas, by the slow cooling of which, basaltic and other crystalline rocks might subsequently be formed. Supposing this theory to be well founded, it will, of course, supersede those older hypotheses, according to which volcanic fires are owing to such chemical causes as the combustion of mineral coal, the action of sulphur upon iron, &c. Sir Humphrey acknowledges, however, that the hypothesis of the nucleus of the globe being composed of matter liquefied by heat, offers a still more simple solution of the phenomena of volcanic fires.

Bank of England Clock.—"The clock, in a building immediately over the Hall, or Drawing Office, is a very ingenious piece of mechanism, and intended, as it fully does, to obviate the difficulty experienced in the various Stock Offices, from the difference of clocks. This, with the dials at the Bank, cannot occur; for the hands of all are moved by one piece of machinery, and the whole, sixteen in number, indicate the precisely similar hour and second. The communication between the machinery and the hands is made by means of brass rods, arranged within the roof, and thence continued to the different apartments in the Offices. The length of the whole of these various rods is nearly 700 feet, which weigh at least 6 cwt. There are 200 wheels in motion; the principal weight is about 350lbs., and the clock is wound up twice a-week. It also strikes the quarters and hours on large bells."—*Thomas's Wards of London.*

Dog Mill.—A mechanic of the name of Mathias, of Troz (N. S.), has in operation a mill for sawing timber for sashes and window blinds, driven by four dogs. They are worked two at a time, for about fifteen minutes; when the team is taken off, and a relay of the two other dogs put to labour. They travel on the circumference of the inside of a wheel about twelve or fifteen feet in diameter, which gives motion to the machinery, which drives a circular saw with great velocity. The cost of keeping the four dogs is estimated at only sixpence per day.—*American Paper.*

NEW PATENTS.

William Roger, Norfolk-street, Strand, Lieut. R.N., for certain improvements on anchors.—13 March—6 months.

Robert Griffith Jones, Brewer-street, Golden-square, for a method of cementing china and certain other compositions, which he denominates letnophanic, translucid, or opaque china; communicated to him by a foreigner residing abroad.—13 March—2 months.

George Scholefield, of Leeds, mechanic, for certain improvements in or addition, to looms, for the purpose of weaving woollen, linen, cotton, silk, and other cloths.—13 March—6 months.

NOTICES TO CORRESPONDENTS.

Subscribers, in possession of incomplete sets, are informed that a small stock of odd Numbers is still on hand, out of which they may probably be supplied with what they want, at the original price.

Communications received from Reuben Godolphin—W. A.—S. C.—Mr. Utting—Mr. Jopling—Mr. M'Vay—Mr. Dakin—An Ex-Leicestershire Farmer—Mr. W. Thomas—A Looker-on from the South.

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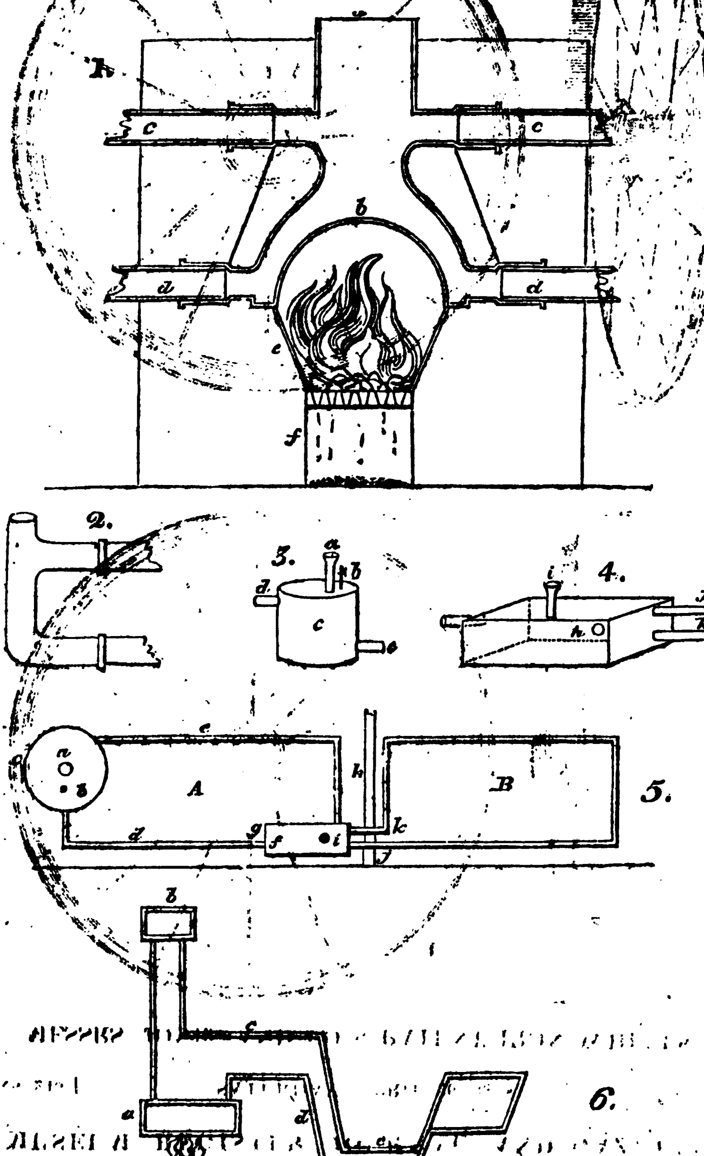
SYSTEM OF HEATING BY WATER.



SYSTEM OF HEATING BY WATER: ILLUSTRATIONS AND IMPROVEMENTS.

Since the notices which we gave of the new system of heating houses by hot water in our last volume, pp. 337, 392, and 415, a great deal of additional light has been thrown, both on the history and on the practice of the art, by several articles which have appeared in the "Gardener's Magazine;" and of these, therefore, we now propose to give some account.

Art. 13, of No. 12 of the "Gardener's Magazine," is an "Account of the Experiments made by William Atkinson, Esq., F.H.S., which led to the Heating of Hot-houses by Water, by Mr. John Barrow, Manufacturing Smith." From this, it appears that Mr. Atkinson mentioned to Mr. Barrow, early in 1822, an idea that he had of heating forcing-houses with water, and that, before the expiration of the same year, Mr. Barrow made a model of an apparatus for the purpose, from a drawing with which Mr. A. furnished him. In this model there were two pipes; one for conducting the hot water from the boiler to the reservoir, and the other for conveying it back again to be re-heated. In the year following Mr. Atkinson was introduced to the late Mr. Anthony Bacon, who had engaged nearly about the same time as Mr. A. in making experiments to heat forcing-houses with hot water, but had employed one pipe only, and succeeded, therefore, but imperfectly.* On Mr. A.'s explaining the principle of action in his model, and the necessity of having two pipes to cause a circulation, Mr. Bacon employed him to construct an apparatus on that plan for the forcing-houses at Elcot; and it was accordingly *under Mr. Atkinson's directions* that the system of heating, which we formerly noticed (p. 338) as being devised by Mr. Bacon himself, was executed. After the hot water had been brought into use at Mr. Bacon's, the same plan was successfully adopted in a pine pit, about 100 feet long, at Lord Carnarvon's; and in 1826 Mr. Atkinson applied it to a conservatory of his own, 60 feet long. Mr. Atkinson, it farther appears, had suggested the use of square pipes instead of round ones, for the sake of the greater surface which they would afford; a suggestion, it will be observed, similar to that since offered by our own correspondent, Mr. Saul (p. 392, vol. viii).

Following this article of Mr. Barrow's, there is another in the same No. of the "Gardener's Magazine," by Mr. Thomas Tredgold, Engineer, who was the principal assistant of Mr. Atkinson in 1822, and who fully confirms the preceding statements of Mr. Barrow. Mr. Tredgold, however, candidly observes, that there were "unsuccessful or uncompleted trials (by other persons) of an earlier date." "In 1799, Mr. R. Weston proposed to heat pine stoves and beds by hot water," (Repository of Arts, vol. xiii. pp. 238 and 314, old Series); and Bosc has the following passage in his Art. *Serre*—(Dict. Agricult. Ency. Meth. 1816)—"I witnessed some trials made in the garden of the Museum, of heating the houses by means of copper pipes, filled with hot water, incessantly renewed: but the plan was given up, because the heat was found in all weathers too equal in degree, and too weak during frosty weather" Mr. Knight, too, proposed a combination of the action of steam and hot water (Hort. Trans. ii. 334); "And this," Mr. Tredgold adds, "I have partially put in practice with considerable success."

Mr. Loudon, the editor of the "Gardener's Magazine," in a note appended to the two preceding

* Mr. Bacon is said to have taken the idea of heating hot-houses by hot water from having seen a leg of mutton boiled in a horse pail,—a feat sometimes performed for a wager at fairs. The breech of a gun-barrel is put into the fire, and the muzzle inserted into the side of the pail, near the bottom, and a strong fire being kept up, the water in the pail is made to boil, and kept boiling by its communication with the heated end of the gun-barrel.

articles, carries back the origin of the plan of heating by water to a still remoter period. It appears from the Dict. Tech., under the articles *Assainissement*, *Incubation*, and *Chaleur*, that the system was actually reduced to practice by M. Bonnemain, a French physician, as early as 1777. M. Bonnemain applied it to the hatching of chickens, and occupied himself in this way as a matter of business, in the neighbourhood of Paris, during the fifteen years which preceded the commencement of the French Revolution. He is said to have also applied it with success to the maintenance of an equal temperature in stoves and green-houses, and to have recommended its application to hot-beds. His apparatus for hatching chickens by hot water is described in Mr. Gill's "Technological Repository" for February last. A pamphlet was published by M. Bonnemain on the subject in 1816; and from this pamphlet certain improved plans of a similar kind, afterwards promulgated in London by another Frenchman, Count Chabannes, and at a period prior to the experiments of Messrs. Atkinson and Bacon, are supposed to have been derived. The pamphlet published by Count Chabannes is without date, and not paged; but, as appears from internal evidence, it was written in 1819. The author states, that at his Manufactory, No. 121, Drury-lane, "may be seen the new mode of warming by a circulation of hot water;" and also that Nos. 36 and 37, Burlington Arcade, established as a depôt "for the purpose of receiving orders for the Manufactory, 121, Drury-lane," are warmed in the same manner. A quarto plate and description are given, clearly illustrating this mode of heating, as applied at the depôt. In the same pamphlet Count Chabannes states, that "conservatories, hot-houses, and hot-beds, have been heated upon this principle with the greatest success." That Count Chabannes completely understood the subject, will appear from the following extract:—"There cannot be a more perfect idea of the whole operation of the new patent water calorifere, than by comparing its boiler to the human heart, and the tubes through which the water passes to the blood vessels of the human body. In the water caloriferes the water is in constant movement, as the blood in the veins; it goes out of it by an upper tube, as the blood by a valve in the heart. It circulates through the house, ascends or descends at will, and returns into the boiler at the bottom to charge itself again with fresh caloric, as the blood ascends, descends, and passes again into the lungs to regain a new portion of oxygen, and recommences constantly the same function of carrying heat to the extremity of the body. The fire-place is surrounded by a boiler, from the top of which an ascending pipe leads to a reservoir, which is filled with water and placed at the upper part of the house, or any where above the said boiler, and from which a descending pipe communicates underneath the boiler, which may be carried in any direction. The rarefaction thus produced by the heat in the ascending pipe occasions a pressure from the colder water in the descending pipe, which establishes a perpetual circulation, and by this means performs the object of carrying the caloric wherever it may be desired."

From a subsequent communication by a correspondent of Mr. Loudon's ("Gardener's Magazine," No. 13, p. 63), it appears that the conservatory of Mr. Scott, at Sundridge Park, was one of those to which a hot water apparatus was successfully applied by Count Chabannes, and that as early as 1816 or 1817.

Mr. Loudon was at first led by these facts to conclude, that the mode of heating by hot water was "clearly of French origin" ("Gardener's Magazine," No. 12, p. 432); but having been subsequently informed by several correspondents that the same system had been long practised by Messrs. Boulton and Watt, of Soho, he wrote to them for information on the subject, and received such an answer as makes it almost certain that the honour of the invention belongs, after all, to

our own country. "We may briefly observe," say Messrs. B. and W. ("Gardener's Magazine," No. 13, p. 30), "that the attention of this firm has been directed to the employment of steam and *hot water* as media for the transmission of heat, *upwards of fifty years;* and they have been used by us with that view, under almost every modification, in the warming of rooms for all the various operations of manufactories, for habitations, for the heating of baths, vats, and various other purposes. Preference was given to the one or other, according to the circumstances under which the application of heat was required,—steam being naturally preferred for the more rapid diffusion of a high temperature, and water substituted when the heating of that liquid to a low temperature, or the steady maintenance of such a temperature in a room, were the objects to be attained. The application of these principles to the warming of hot-houses has not attracted much of our attention, not possessing ourselves any house of that description; but the adoption in them of modes of heating practised in other buildings where analogous desiderata were attained, must, we conceive, be a natural consequence of the diffusion of the practice."

So muchfor the history of the system. Some improvements in the practice of it next claim our attention.

Mr. Loudon, in some notes on Mr. Whale's practice at Elcot, had stated that the circulation of the hot water might be kept up, *however low the pipes might descend;* and this statement was transferred to our pages, along with the substance of Mr. Whale's account ("Mechanics' Magazine," No. 225). A Mr. Byers, of Swansea, states, however ("Gardener's Magazine," No. 13, p. 61), that he had constructed a heating apparatus on this principle, but found, by a variety of experiments, that when *the pipes were in any part lower than the boiler,* the heat would not pass beyond that part.

"Mr. R. Evans," says Mr. Byers, "who made my apparatus under my own immediate instructions, made a working model, which I have just seen in operation; and to satisfy himself that my plan was correct, he had union joints in the delivering pipe, and also in the returning pipe, so curved, that when turned down they were below the level of the bottom of the boiler; and the consequence was, the hot water was as much cut off as if a stop-cock had been in that part of the pipe; but as soon as the bent pipe was brought up to a level, the heat proceeded forward immediately." Mr. Byers has added drawings of his amended apparatus, which we have transferred to our front page (see figs. 3, 4, and 5); and the following is his explanatory description:—

"*a*, the feeder, allowing for the expansion of the water; *b*, stop-cock in the top of the boiler, which serves as a guide to fill the boiler; *c*, boiler; *d*, delivering pipe; *e*, returning pipe; *f*, reservoir; *g*, pipe connected with delivering pipe; *h*, pipe connected with returning pipe; *i*, pipe and funnel like *a;* a loose cork is placed at the top of each; *j*, delivering pipe to the green-house, B; *k*, returning pipe to the green-house. The whole apparatus is made of thin copper. The pipes in the stove A are three inches in diameter, and those of the green-house B one inch and three quarters in diameter; the size of the boiler, two feet in diameter and one foot deep; and the feeder *a*, nine inches high and two inches in diameter, so as to allow a thermometer to be introduced; the funnel, at the top, six inches in diameter; the reservoir three feet long, one foot six inches wide, and one foot deep. This apparatus will heat a stove of from twenty to thirty feet, and a green-house of the same dimensions."

Mr. Byers gives, in a subsequent letter, the following explanation of the cause of the hot water not descending below the bottom of the boiler:—"Hot water being specifically lighter than cold water, nothing but extraordinary pressure can force the hot water into a place that, by the law of gravity, it could not occupy

without such pressure. This pressure not being used, the consequence is, hot water cannot descend below the source of heat."

Mr. Loudon has subjoined to Mr. Byers' communications the following note. Messrs. Bailey's model, to which he refers, is represented by fig 6, in our front page.

"Our correspondent is quite correct; hot water will only descend below the level of the vessel in which it is heated, under such arrangements as those adopted by the Marquis de Chabannes, or as exemplified by Messrs. Bailey, in a model now at work on their premises, 272, Holborn. In this model, the water, after being heated in the boiler *a*, rises to the covered reservoir *b*, several feet above it, from whence it descends *on the principle of pressure* by the pipe *c*, and returns to the boiler by pipes considerably below its level *d*, which may be bent in any direction. This application may be useful both in the case of dwelling-houses and hot-houses; and it has already been applied by Messrs. Bailey, in the case of a green-house where it was necessary that the pipes should descend below the path-way (as at *e*)."

The arrangements of the Marquis de Chabannes, here alluded to by Mr. Loudon, are those before mentioned, by which the Marquis heated the different stories of the houses, No. 36 and 37, Burlington Arcade. A particular description of these will be of great use to builders and others desirous of applying the system to the warming of houses and manufactories, but this we must defer till next week.

We have, at present, only room to add, "An account of some improvements made in the apparatus for circulating hot water in hot houses, by Messrs. Cottam and Hallen, of Winsley-street, London." Mr. Cottam, the writer of this account, says it is an error to suppose that it is necessary the boiler should hold a great quantity of water; for that he has ascertained by experiment, that no more water is required "than what will cover a surface sufficient for the heat, from the requisite portion of fuel consumed beneath it." The boiler (represented by fig. 1, on our front page) is stated to be "of a shape the most advantageous for this purpose; it exposes a greater surface to the fire than any other form; and what deserves particular attention is, that this surface is in the best possible situation for receiving the greatest quantity of heat from burning fuel." "By narrowing the top of the boiler *a*, the heat received from the fuel is immediately conducted from all points of the bottom surface *b*, to the entrance of the pipe *c*, through which it is to be circulated. In consequence of this, there will be less accumulation or retention of heat in the boiler, and a more immediate and rapid circulation than in the case of square, oblong, round, or any other description of boiler hitherto in use for heating hot-houses." *d d* are the returning pipes; *e* the fire-place; *f* the ash-pit. "The top of the boiler may be covered with a lid of wood, iron, or stone; and where the circulation is extensive, as in the case of heating several houses from one boiler, the motion of the water will be promoted by leaving the lid loose, and by having one or two openings for the admission of the atmosphere into the conducting pipes. I have clearly proved, by experiments with copper models, that these openings or air-pipes increase the circulation; and I have had cast-iron elbows made with air-pipes (see fig. 2, front page), which I can introduce at pleasure, instead of large reservoirs, or use with or without them, according to the nature of the house to be heated."

MR. CHILD'S INVENTIONS FOR THE PRODUCTION OF GEOMETRICAL FIGURES BY CONTINUOUS MOTION.

Sir,—Having seen the communications of Mr. Child, near Halifax, in your valuable work, and being desirous to know something more of the curious instrument by which the figures engraved from his specimens

were produced, I embraced the opportunity of being at Halifax on business, to pay him a visit, that I might, for the gratification of myself and an ingenious contributor to your publication, see the original figures, as I was aware of the difficulty of engraving such figures on wood. Being very much gratified with my reception, and surprised by the powers of the instrument, I devote, on my return, a short time to you, hoping you will favour me, and perhaps others, by giving this communication to the public.

Mr. C. mentioned that he had sent some other letters to you, besides those which I have seen published. He referred particularly to those dated January 12 and February 9, 1828;* and, under such circumstances, thought he ought not, *without reserve,* to comply with my request; but would show me such things as would, he hoped, convince me that its powers are, perhaps, unlimited in the description of geometrical figures. He showed me that the spiral may be described by the reverse of the trammel, but in parts only; viz. by half a revolution at one *setting* of the instrument, and then carefully joining the lines at each setting for the succeeding parts; that a volute also may be drawn in the same way; but that this figure is only such an approximation to the true volute, as a spiral drawn with compasses is to the true spiral; such volutes being composed of distant portions of the *Archimedian spiral,* neatly joined, the intermediate parts being rejected. But the instrument which was the object of my visit, and to which he has not given any name, produces figures which are unquestionably the true *Grecian volute,* in one continued line, and in as short a time as one might draw a circle with compasses. He very kindly presented to me several volutes of very different sizes and degrees of curvature: some described in one line, some in *double parallel* lines, and others with the *double lines diverging* from the eye to the extremity, both elliptical and circular ones of each kind.

The eye of the volute is formed by the instrument, but the diameter of it is at the discretion of the person using the instrument. Those figures are, so far as correctness of line is concerned, equal to any *engravings on copper,* but the lines are necessarily *strong,* being drawn with a pen in form of a fine *tube.* I am of *opinion,* there is not an instrument known to the moderns by which this figure can be drawn with such accuracy and expedition; though, from the comparative simplicity of the mechanism, Mr. C. thinks it was, probably, known to the ancients. Although I use the term *comparative simplicity,* I would be understood to say that the construction is upon principles purely geometrical and mechanical, without any unwinding of a string, &c. from a fusee, or making a *rack revolve upon a cone,* by means of teeth placed spirally from the apex to the box. You have but to arrange the parts for what you intend to produce, and then turn the winch from left to right, or from right to left, without interruption, till the figure is completed. Figures endless in variety and beauty are produced by it, with the greatest facility and accuracy, either similar or dissimilar in corresponding parts. It describes the outline of various natural productions, such as fruit, eggs, &c.; and, indeed, although the whole of this curious invention was not laid before me, I am well convinced there is *not another instrument* equal to it.

Thinking it probable that you will publish Mr. C.'s other communications, I will not trespass further on your valuable pages; but permit me to say, that as a knowledge of this invention will, doubtless, be an acquisition to the mechanic as well as to the man of science, the sooner it is generally known the better.

I am, Sir,
Your most obedient Servant,
F. ALEXANDER.

P. S.—Mr. C. very politely showed me instruments for drawing the

* The two letters inserted in our last Number.

parabola and hyperbola, which are constructed without wires or strings, and which are original inventions.

[Since submitting to Mr. Jopling's inspection the packet of specimens executed by Mr. Child's instruments, noticed in our last Number, we found that we had overlooked two other packets which Mr. C. had transmitted to us. We therefore forwarded these also to Mr. Jopling, and the following is his answer.—EDIT.]

ON MR. CHILD'S SPECIMENS.

Sir,—I have to acknowledge the receipt of two other packets, containing, together, eighty-eight more specimens of Mr. Child's curves. As they contain the same general distinctions in the character of the lines that I pointed out in the former packet, it is, perhaps, unnecessary for me to make any other remarks on these, than that there is one specimen of an elliptical parallel spiral; but there are neither hyperbolas nor parabolas amongst them.

There are very few lines amongst Mr. C.'s specimens that I have ever drawn (not having entered much into combinations); it may not, however, be improper that I should give your readers a general description of the method of producing many such like curves; which I am enabled to do, by knowing the effects of first principles.

For example, the motion of a surface may be so regulated by a combination of wheels, that one point, or a series of points, shall describe right lines—others elliptical lines—others triangular lines, &c. Now, if the centre of another wheel be fixed to any such point, and at the same time a rotary motion be given to it, it will regulate the motion of another plane; so that while one point shall be moving in a right, elliptical, triangular, or other line, any other point will have a rotary motion crossing the path of the former.

I arrange the first principles of regulating the motion of a surface, by wheels, into four classes; and these contain six cases of simple motion. To these, as I have already said, I have given terms.

As the rotary motion of the plane may be uniform, the path of its centre may be equally divided; which, with respect to the ellipse, Mr. Ibbetson has pointed out in your 204th Number, page 16; and, as it appears from Mr. Child's specimens, he had previously performed.

Of course, any other point than the centre of the wheel may move in a given line. In the simple combinations of wheels, the axis of the one in motion always describes a circle.

If the centre of a plane having a rotary motion move in a line with a number of nodes, cusps, or points of contrary flexure, the path of any other point will be still more complicated.

The specimens of lines produced by *toothed* wheels are generally small. The reason of this, I apprehend, is, that if large curves are attempted to be produced by small wheels, the most trifling shake would be so multiplied as to become quite perceptible; whereas, by drawing small lines, the shake is rendered less, or altogether imperceptible.

I am, Sir,
Your obedient Servant,
JOSEPH JOPLING.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

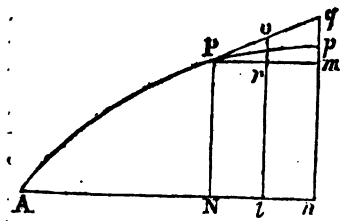
(*Continued from p. 400.*)

13. What we have said of the fluxions of curvilinear areas applies equally to the lengths of curved lines and the content of solids.

Suppose A P (fig. 1, next page) to be a curve line, which is described by the end P of the line N P moving along the indefinite straight line A N, and that P q touches it at the point P; let N n, as before, represent the fluxion of the axis A N; produce

$n\,p$ to meet the tangent in q, and

Fig. 1.



through P draw P m parallel to N P; and let P p represent the increment of the curve in the time N n.

It is evident, from the definition which we have given of a fluxion, that the line P q represents the fluxion of the curve A P at the point P; for P q is the space which the generating point P would describe, in the direction in which it was advancing when its motion became uniform, in the time that the ordinates received the increments N n $m\,q$. Also P m is equal to N n; and therefore represents the fluxion of the axis; for since $q\,m : m\,P :: o\,r : r\,P$, we perceive that N P has increased uniformly to the magnitude $n\,q$, in the time N n; and hence $m\,q$, the space by which it has increased, represents the fluxion of N P. Now, by Euclid, $\overline{Pq}^2 = \overline{mp}^2 + \overline{mq}^2$, or the fluxion of the curve A P $= \sqrt{m\,P^2 + m\,q^2}$; a result of which we shall presently see the use.

14. Again, if we suppose the foregoing figure to revolve about its axis A N n, the curvilinear area A P p n will generate a solid bounded by a curved surface, and the parallelogram N P m n will describe a cylinder P P P m m m (as in fig. 2).

We may suppose this solid to have been generated by the advance of the circle P P P (fig. 3), whose centre is always found in the line A N n of the axis, and whose plane is parallel to that determined by the lines A I A Y (both perpendicular to the axis), which, while it advances, keeps continually dilating itself. When its centre arrives at the point N, suppose it to remain of the same size, and to advance as far as

Fig. 2.

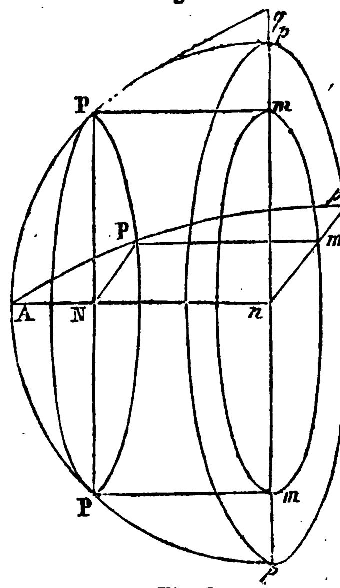
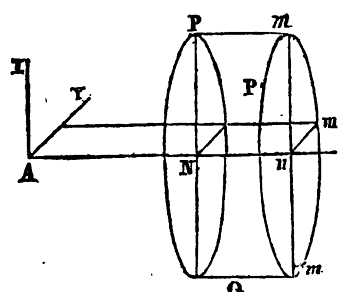


Fig. 3.



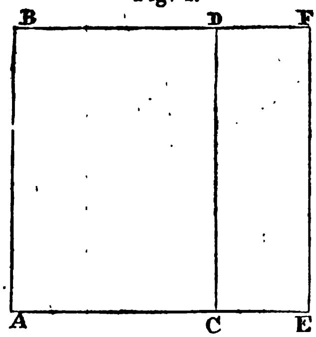
n; it is manifest that the slice P P P m m m, fig. 2, is the increment which the solid receives in the time N n; and that the cylinder P P P m m m is the increment it would have received had the advancing circle remained constant; and hence we have the cylinder P P P, m m m for the fluxion of the solid A P p. To recapitulate: we have the straight line P q (in fig. 1), for the fluxion of A P; the area P m n N (fig. 2, p. 90), for the fluxion of A N P; and the cylinder P P P m m m, (fig. 3), for the fluxion of the solid A P P P.

15. We shall have rather more diffi-

culty in finding the fluxion of a curved surface; and we cannot, as in the three other cases, give a delineation of its figure.

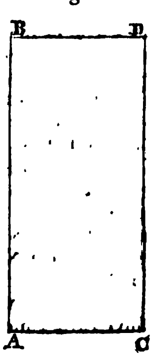
Drawing P Q, a tangent to the curve A P, at P, P Q will represent the fluxion of the line A P, if M n n represent the fluxion of the axis.

Fig. 4.



We showed (page 89), that if a straight line A B (fig. 4) move parallel to itself along the line A C E, that, C E being the fluxion of A C, the parallelogram C F will be the fluxion of the surface A D: in short, that the fluxion of the area or surface generated by the motion of a line, is equal to the line itself multiplied into the velocity with which it moves. To apply this to the case before us, we must make the curve A P revolve round its axis A N; then the point P will trace the circle P P P; the surface or area traced by the uniform advance of this circle, will be the same as that traced by an equal straight line A B (fig. 5): and as each point in

Fig. 5.



this circle moves forward with the same velocity as the point P by which it is generated, the circle P P P multiplied into P *q*, the velocity with which the point P advances, will represent the fluxion of the surface generated by the advance of P P P. If we take A C (fig. 5) equal to P *q*, then A C being equal to P P P, the rectangle A B D C will represent the fluxion of the surface P A P.

(*To be continued.*)

CIRCULATING DECIMALS.

Sir,—In my paper on the Reciprocals of Prime Numbers (vol. ix. p. 166), I made no pretensions to originality respecting the *sum* of the *two halves* of the circulating period being *nines*, or to that of the *remainders* being equal to the *divisor;* but merely stated that the numbers 31, 37, and 41, did not answer the conditions proposed,—that the circulating period must contain an *even* number of figures,—and that when the remainder is an unit less than the divisor, the circulating period is half obtained. I am, therefore, at a loss to understand what your correspondent, an "Old and Cordial Friend" (p. 199), means, when he says, "In these properties, as you will perceive, *the results announced by Mr. Utting are completely anticipated.*"

In respect to what has been inserted in the "Ladies' Diary," that I have no knowledge of. But as regards Mr. Brown's demonstration, in which your correspondent says he presents *another property!* I must observe that this property was presented to the public in 1802, upwards of twenty years previous to its publication by Mr. Brown! as may be seen from "Nicholson's Journal," vol. i. p. 316, where an example is given by means of the very same prime divisor, viz. 23, and which, as your correspondent remarks, is, I believe, due to Mr. Goodwyn (the annexed signature being H. G.)

There are some Tables of Mr. Goodwyn's inserted in Dr. Gregory's Mathematics for Practical Men, at the end of which Dr. G. remarks,—"The preceding Tables were com-

puted with great care by the author's esteemed friend, the late H. Goodwyn, Esq., of Blackheath; a gentleman, whose indefatigable perseverance and remarkable accuracy, in reference to numerical computations, cannot be too highly characterized. They are inserted here, to supersede the necessity of consulting some erroneous Tables of the areas, &c. of circles, recently put into circulation." (Page 406.)

I also have computed Tables of the *areas* of circles, their *circumferences*, and the *sides* of squares, of *equal areas*, for all *diameters*, from 1 to 1000; and of the *diameters*, *areas*, and *sides* of *equal squares*, for all *circumferences*, from 1 to 1000, each to ten places of decimals; which are now in the hands of the Astronomical Society of London. I have compared the column of areas for the first 100 numbers with those in Dr. Gregory's work, from which I have collected the following list of Errata in Mr. Goodwyn's Table, viz.

TABLE II.—(*Of Supplementary Tables.*)

In the column of areas,

Nos.	7, for	88·48456000,	read	38·48451001
——	16, —	264·46900493,	——	254·46900494
——	19, —	283·52873696,	——	283·52873699
——	24, —	452·38934207,	——	452·38934212
——	28, —	615·75216017,	——	615·75216010
——	33, —	855·29859989,	——	855·29859994
——	40, —	1256·63704143,	——	1256·63706144
——	56, —	2463·00864068,	——	2463·00864041
——	61, —	2922·46656692,	——	2922·46656600
——	64, —	3216·99087720,	——	3216·99087728
——	65, —	3318·30724030,	——	3318·30724035
——	96, —	7238·22947380,	——	7238·22947387

In the areas for numbers 22, 27, 30, 32, 39, 45, 48, 51, 54, 57, 60, 62, 66, 69, 72, 75, 87, 90, 99, the last figure should be increased by 2.

In numbers 1, 8, 9, 10, 14, 16, 20, 21, 23, 26, 29, 34, 36, 38, 41, 42, 44, 46, 47, 49, 50, 52, 55, 58, 59, 63, 68, 70, 71, 74, 78, 81, 84, 85, 86, 88, 89, 92, 93, 94, 95, 97, and 98, the last figure should be increased by unity.

One twelfth part only of the above Table (or Table II.) has been examined by me; and if these Tables can be called accurate (!!)—what must the erroneous Tables referred to by Dr. Gregory be?

J. UTTING.

Lynn Regis, April, 1828.

P.S. I have no intention of detracting from the merit of the works published by Dr. Gregory, as no person, I presume, has a higher opinion of their excellence; at the same time, I cannot help expressing my disappointment in respect to the accuracy of the Tables alluded to: whether the errors originated in the *computations*, or with the *compositor*, it is not my province to decide.

FIELD-GATES.

Sir,—The "North Star's" field-gate (p. 190) requires only the errors in its construction, and in his observations upon it, to be pointed out, to render them obvious. In many parts of the *north* of Lancashire I have seen field-gates constructed upon Mr. Waistell's plan; but I suppose your "North Star" has not yet shined upon them. In that part of the country, the openings of the gateways, or the distance between the gate-posts, are generally much less than in many other counties; sometimes not seven, and seldom exceeding eight feet. Such short gates, of course, cannot require to be made of the same scantlings in their several parts as those for openings of ten feet, which the dimensions given by Mr. W. are designed for; but the principle of construction found to be the best for the largest will be also found to be the best for the least. The great dis-

tance between the ground and bottom bar, and between the two bottom bars, show that the "North Star's" gate is not intended as a fence to enclose pigs or lambs, although it has precisely the same character in its construction as the sheep hurdles in the south, to which I have already alluded.

Your correspondent has misapplied his roof-reasoning. The bottom bar of a gate cannot be considered to be like the tie-beam of a roof. A tie-beam is supported at both ends; a gate only at one end.

Neither can his braces be considered as rafters. The principal rafters of a king post roof are both strained longitudinally in the way of compression. The brace arising from the heel of his gate is strained in the same way; but the strain upon the brace towards the head is *extension*.

A great weight being placed at the head of the gate would not force the braces against the top of the upright bar, as is the case with the top of the rafters against the upper part of the king post of a roof; but such a weight would have a tendency to break the top rail by a transverse strain immediately before the top of the upright bar; for neither the brace behind, nor the upright, have any tendency to strengthen the top bar at that point. Had the upright bar been put on one side of the gate, and both braces on the other, and the front brace parallel to the back one, and the braces, upright, and top and bottom bars, bolted together, there would then have been no transverse strain in the gate; but, for it then to be equally as strong as one on Mr. W.'s plan, the bars and braces must contain more timber, to say nothing of the difference in the appearance.

I am, Sir,
Yours, &c.
JOS. JOPLING.

ARTIFICIAL MOTHER OF PEARL.

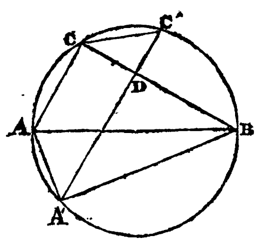
Sir,—In reply to the anonymous inquiry addressed to me at p. 158, on the subject of Artificial Mother of Pearl, I beg leave to say, that want of leisure has prevented me from entering into this process sufficiently to be able to furnish the information required, and which can be obtained by *practice only*.

I should, however, recommend your correspondent to purchase the *very best whole rice*, the ground rice of the shops being neither fine enough nor clean enough for the process of this extremely delicate manufacture.

I am, Sir,
Yours, &c.
W. BADDELEY, Jun.

April 1, 1828.

GEOMETRICAL THEOREM.



Sir,—With my communication on this subject (vol. ix. p. 39), there is inserted a false figure (by mistake, of course), which renders the demonstration quite unintelligible, at least to the majority of your readers. Be so kind as to insert the proper figure, which I again send you with this; as, notwithstanding the reply of F. (p. 60), it will perhaps be still expedient to supply the true figure to my demonstration.

The observations of F. are certainly correct, and his demonstration complete, considered in a fluxional point of view; but my opinion is, that the generality of those persons for whose benefit the demonstrations are intended, would require such a case as I have given. And, indeed, the very example of the *secants*, alluded to by F. as analogous, has been demonstrated with a case for the intermediate degrees; viz. when the secant does not pass through the

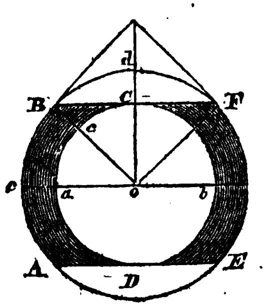
centre. (See Euclid, iii. 30.) F. may therefore still consider his demonstration as complete, and yet permit the additional case to remain for the use of the geometrical students of the "Mechanics' Magazine."

I am, Sir,
Yours, &c.
VECTIS.

SOLUTIONS OF THE PROBLEM IN MENSURATION—(p. 30. vol. ix.)

Problem.—*Required a square equal in area to the space comprised between the arcs (A B, D C, and E F, D C) of two concentric circles, and two parallel right lines tangents to the interior circle, the area of the exterior circle being double that of the interior.*

SOLUTION BY J. R. (THE PROPOSER.)



Let A B F E and *a* C *b* D be the two concentric circles. Bisect the quadrant *o c d* by the line *o* B; then will B *c a e*=*a e o*=*o e* C, by the nature of the problem. To each of these equals, viz. B *c a e* and *o e* C, add the area *e* B C; then will the area of the triangle *o* B C=the space *c* B C *a*. On B *o* construct the square *o* B *v* F, and it will be equal to four times the triangle *o* B C, or four times its equal *c* B C *a*, which is equal to the space A B, D C, and E F, D C.

BY VECTIS.

Put O D$=a$, O E$=b$, the decimal factor $\cdot 7854=d$, and $x=$the area required. Then, the greater circle$=4\,b^2\,d$, less circle$=4\,a^2\,d$, and segment A E + seg. B F$=\frac{4\,b^2\,d-4\,a^2}{2}$ $=2\,b^2\,d-2\,a^2$; and this quantity, together with the less circle, being taken from the greater circle, leaves the spaces; that is, $x=2\,b^2\,d+2\,a^2-4\,a^2\,d$. But, by the question, $2\,a^2=b^2$; hence, by substitution, $x=2\,b^2\,d+b^2-2\,b^2\,d=b^2=$the square of the greater radius.

BY BRIAN EVRED, OF MONMOUTH.

Let the area of the exterior circle be 4840 yards; then, per question, the area of the interior circle is 2420 yards; whence, $\sqrt{\frac{4840}{\cdot 7854}}=78\frac{1}{2}$ yards, the diameter of the former, and $\sqrt{\frac{2420}{\cdot 7854}}=55\frac{1}{2}$ yards the diameter of the latter, circle.

Again, $\frac{78\frac{1}{2}-55\frac{1}{2}}{2}=11\frac{1}{2}$, the height of the two similar and equal segments, cut off by the tangents drawn to the interior circles, and $\frac{11\frac{1}{2}}{78\frac{1}{2}}=\cdot 1465+$; the tabular area answering to which is $\cdot 074573$, and $\cdot 074573\times\overline{78\frac{1}{2}}^{2}\times 2=949.49$, the area of the two segments: hence $2420-949\cdot 49=1470\cdot 510$, the area of the space included between the arcs and the tangents $\therefore \sqrt{1470.510}=38.34$, the side of a square equal in area to the said space as required. It appears that the side of the required square is *nearly* one yard shorter than the radius of the exterior circle.

[Solutions of this problem have also been received from Mr. Mackinnon, Mr. Dowling, J. P. N., and Mathematicus.]

REMARKS ON THE SOLUTIONS OF THE GEOMETRICAL PROBLEM PROPOSED IN No. 234.

We have received letters from two esteemed correspondents, "F." and "G. S.," both containing objections to the accuracy of the solution by Q.E.D., inserted in our last Number, of the geometrical problem, proposed in No. 234. "F." objects,

"1st, That in laying down the lines A B, A C, A D, regard has been had to their extent, and not to their position. 2dly, That the angular points being indeterminate, it is erroneous to determine them, and then to take D C=B D. And, 3dly, That the point A being supposed to be *any where* in the interior of the triangle, "Q. E. D." has consulted his convenience merely, in so placing it, in respect of the radius of *his* circle, that it shall divide its chord, B D, into two equal parts."

"G. S." affirms, generally, that the solution is "wholly incorrect," and adds the following remarks:—"The problem, as originally given, was very badly ennunciated; neither was there any necessity for restricting the required triangle to an isosceles right-angled triangle. The general enunciation ought to have been as follows:—*Problem*—To construct a triangle similar to a given triangle, and to find a point within the required triangle, such that if three straight lines be drawn from that point to the three angles of the required triangle, these three straight lines may be respectively equal to three given straight lines."

We invite "Q. E. D." to revise his solution, and refute, if he can, the objections made to it. We shall also be glad to receive from "G. S." or any of our other correspondents, a solution of the problem, according to the amended form in which he has proposed it.

HIS MAJESTY'S SHIPS ASIA AND GANGES.

Sir,—I shall be happy to give "An Admirer of Naval Architecture" the slight information I possess respecting the Asia and Ganges; but, at the same time, I merely supply it, as being better than none, with the hope that some other correspondent may supersede this by a fuller account of these vessels. I merely send an extract from "James's Naval History," as to the dimensions, &c.

These ships were built from one draught, being that of the "Canopus," formerly the French "Franklin," taken at the Nile.

There are also seven other ships built on the same model, and of like dimensions.

These are,—

	Feet.	Inches.
Length of first deck	193	10
Extreme breadth ..	51	6½
Depth in hold	23	4½

Burthen in tons, builder's tonnage, 2257.

The "Tonnant," I believe, is of still larger dimensions, having greater relative breadth. These ships, indeed, are, in respect to their proportion of length to breadth, among the longest vessels in the navy; they exceed, at least, the average proportion of the line of battle ship classes.

I am sorry that I can give no farther information of the qualities of these ships, than can be gained from an indistinct recollection that I heard the qualities of the Asia spoken of, in comparison with those of the Caledonia, as being inferior on a wind, according to the rates of their respective logs, but faster when sailing free. It is, of course, probable that these ships would be more weatherly,—a quality as to which the log will afford no comparison.

So great is the importance of any information as to the comparative excellence of ships, where draughts have been thoroughly examined, that I will make no farther apology for the scantiness of this notice.

I am, &c.

PHILO-NAUT.

[The inquiries which Philo-Naut. makes, in his turn, respecting the best construction of fast sailing vessels, shall be given in our next.—EDIT.]

EXTIRPATION OF THISTLES.

Sir,—As the grazier will shortly be subject to many unpleasant intruders upon his land, a few sentences more in addition to what your correspondent, Francis Dubois, has said on the extirpation of thistles, may not be unseasonable to your old friend S., and some others of your readers, at this time. This old friend has not in-

formed us how his land, so much subjected to thistles, has been occupied for some years past. I conjecture it to have been grazed chiefly with sheep, which annoy thistles as little as any stock; they will graze as close as possible without touching them. As a cover of weeds, while growing, is an annoyance to any crop, so is the thick cover of a good crop an annoyance to weeds. I would therefore recommend a good cover of grass as early in the spring as can be obtained on such pieces, before the thistles make their appearance, in order to keep them in back ground as much as possible, until the grass is ready to be eaten. The ground should be then stocked closely with beasts, which make no bones of thistles, while tender and wrapped up with young grass. When afterwards laid to rest again, such of the thistles as may have escaped the hard mouthed beast must be *hacked* up.

In the case of land stocked with sheep, I see no better remedy than your correspondent F. D.'s, namely, "a merciless war," which will certainly weaken, if not entirely extirpate, the enemy; but I have, for many years past, provided my forces with much easier, and, on that account, more expeditious, weapons, than those recommended by him, and which have become pretty general wherever known. I call them *thistle hacks*; they are similar to a mattock, with a broad end for earth, &c. varying from 1½ inch to 2½ inches broad, and in length,

from end to end, 12 inches; they are set like unto a hoe for a stroke, with a straight stail (handle) of four and a-half feet.

Should the enemy become so numerous that the attack appears doubtful, (I believe the difference will be two to one in favour of the thistle-hacker to the turnip-picker, in the same time,) clear the outskirts first, and leave the most formidable parts, where the land is covered over with thistles, for those more expeditious and powerful warriors, the scythe-men. But, although the scythe has the advantage of the thistle hack, when the thistles are thick set upon the ground, it is more injurious to the growing grass, and, consequently, (for the reason before stated) more favourable to the thistle.

Land mown for hay is less subject to thistles than when grazed with beasts. When land is chiefly in tillage, let the ploughshare, or the scuffler feet, where used for the purpose, be so wide and sharp, as to extirpate every one of them at the first encounter; and every time any others shall arise, weed the crop so that none get to seed. When thistles are allowed to run to seed in the fields, or even in the lanes, there is no certainty how far the seed may be wafted by the wind.

Beasts have as great an aversion for docks as sheep have to thistles. When land, therefore, is overrun with docks, it cannot be stocked too early in the spring, nor too close, with store sheep. They will then nip them in the bud; and, by preventing them getting any leaf, they will nearly be destroyed in one season. Care must be taken that there is just pasture enough, so as not to injure the stock. When there becomes a superfluity of grass, the docks are neglected. The dock is early in the spring, and very little, if any, injured by the frost. The thistle is tender, and late in the spring before making its appearance, as though fearful of frost, like the ash, &c. By inserting the above, you will oblige,

Sir, yours,

An Ex-Leicestershire Farmer and Grazier.

MISCELLANEOUS NOTICES.

Stone Ware Tubes.—The greenhouse at Battersea Nursery is heated by a smoke flue, composed of tubes of stone ware, which Mr. Russel the nurseryman, has himself invented, and which are made at a manufactory for this sort of ware at Battersea. The section of these tubes exhibits a square with an elliptic top; they are in lengths of two feet, with a shoulder at one end and a rabbet at the other, for the purpose of being neatly fitted together. The thickness of the material is 1¼ inch, and the clear width within 12 inches by 8 inches. In the middle of the bottom of each length, is an opening 6 inches by 4 inches, for the purpose of putting in the hand and a brush, for cleaning the flue; a cover fits this opening very accurately, and is kept in its place by a small cross-bar of earthenware. Mr. Russel values a flue constructed of this description of tubes, for the neatness of its appearance, and for the ease with which it is heated, and consequent rapid effect in raising the temperature of the house. With thick brick flues, on the old plan, two and three hours are frequently required to bring a greenhouse to a proper temperature; but with these stone ware tubes, the desired heat may be at any time obtained in fifteen minutes. The material of Mr. Russel's flue-tubes, and the mode of manufacturing them, are, he says, only known to the person who has the manufactory at Battersea. In appearance, the material seems to come nearer the Bath stone than any other, is as firm and hard as metal, and fire, water, and weather proof.—*Mr. Loudon, Gardener's Magazine.*

Tainted Wooden Casks may be rendered perfectly sweet and wholesome, by washing with diluted sulphuric acid, and afterwards with lime water, and pure water.—*Journal d'Agric. des Pays Bas.*

The Climbing Boy System.—Another instance of the danger to which chimney-sweepers are liable, occurred yesterday. A boy, not more than seven or eight, was sent up a vent in a house several stories high. When he had proceeded a considerable way up, a large stone was loosened from its place by his foot, and falling down, stuck firmly in the middle of the vent, being too large to get through. The boy ascended a little farther, but found it impossible to get out at the top, from the narrowness of the aperture. He endeavoured to return again, but the large stone had so effectually choked up the passage, that to get past it was equally a matter of impossibility. In this dreadful dilemma, the boy remained for four hours, making the most fruitless attempts to get out. A sergeant of police getting intelligence of the circumstance, humanely obtained the assistance of a smith, and dug a small hole through the gable of the house, through which he conveyed to the little climber some refreshment. Being unwilling, however, to damage the wall any farther, he sent up another sweep, who, after great difficulty, succeeded in bringing down the stone which had stopped the passage. The boy was then brought down. He exhibited a melancholy picture of distress, and it was some time before he recovered.—*Glasgow Chronicle.*

Oldest and Largest Tree.—Humboldt considers the *Adansonia digitata*, a native of Senegal, Egypt, and Abyssinia, to be "the oldest organic monument of our planet," and there can be no question that it is the largest known tree. It is of moderate elevation, but its trunk is sometimes from twenty to thirty feet in diameter. According to a calculation of Adanson's, when its trunk is thirty feet in diameter, it must be no less than five thousand one hundred and fifty years old. The roots and branches spread out to an extraordinary extent. Adanson traced the tap root of a tree, whose trunk was seventy-seven feet in circumference, to the distance of 110 feet. The branches droop at the extremities, and are so entirely covered with leaves as to form a nearly hemispherical mass of verdure, from 140 to 150 feet in diameter, and from sixty to seventy feet in height. (See the vignette to "Macartney's Embassy to China.") The fruit of this tree forms a principal article of food in the countries where it abounds; a drink is also manufactured from it, which is esteemed a specific in putrid and pestilential fevers.

Mode of Claying Sugar in Barbadoes.—A coating of clay, softened nearly to a liquid state with water, is spread over the surface of the sugar as it stands in the deep earthen pots into which it is received from the boiler; and the fluid parts gradually draining away, the clay becomes hardened into a dry cake at the top, while the water passes through the whole of the sugar, and carries with it a considerable portion of the molasses through an opening at the bottom of the pot, leaving the sugar greatly whitened and improved. The clay having become a hard and dry cake, is easily removed from the surface. Sugar, thus improved, sells a third higher than in its raw state.

Manna.—The ancients being accustomed to find manna on different species of trees, inferred that it was a substance wholly foreign to them,—something which fell from heaven, and merely found a resting place on the leaves of the trees. The experiments of modern physiologists, however, have shown that the nutritive juices of all trees are nearly, if not wholly, the same; and that manna is merely these juices in an extravasated state. Manna is procured chiefly from a species of ash, which abounds in Calabria and Greece, called the ornate, or manna ash,—but also from other kinds of ash, and from the larch, fir, orange, walnut, willow, mulberry, and oak. It has been observed that such summers as produce it in the greatest quantities are very fatal to the plant. At Briançon, in France, a considerable quantity is annually gathered from walnut trees; but if they happen to yield more than ordinary, they usually perish the following winter.

Trigonometrical Surveys.—There has been a division of 11 to 10 in the Finance Committee on the question of Trigonometrical Surveys. The expense does not exceed 3000*l.* or 4000*l.* a-year; and the majority have decided that it is better to permit this not very extravagant outlay, than to forego the advantage of the most authentic and scientific maps which have ever appeared in the kingdom.—*Times.*

Stone Dials.—The faces of the clocks of the new churches at Chelsea and Norwood, of the Royal Mews, Pimlico, and of the new clock tower, Windsor Castle, have all, on the recommendation of Mr. Vulliamy, the eminent horologist, been made of stone. In a small pamphlet which Mr. V. has just published on the subject of public clocks generally, he says,—"Stone being an absorbent, and not so good a conductor of heat as metal, the paint adheres better and lasts longer, and does not require to be renewed so often as on the copper dial. Another advantage of the stone dial is, that the centre can be sunk, and the hour hand made to traverse in the sinking. This enables the minute hand to be close to the figures, and then almost all error from the effect of parallax is avoided, which, in the copper dial, is very considerable; especially when the minute hand points at or near 15 and 45 minutes, and the hands are both above the dial. In the stone dials of Chelsea new church, and the Royal Mews, Pimlico, the figures are cut in the stone, and sunk about the eighth of an inch, after the manner of the Egyptian monuments, from which I derived the idea. By this method, supposing the dial

accurately divided, and the figures well shaped in the first instance, they will always remain so."

Latent Heat of the Gases.—Some recent experiments of M. Marcet, on the different gases, show the following facts;—That in equal volumes, and under equal pressure, all the gases exhibit the same specific heat; that, all other circumstances being the same, the specific heat diminishes cotemporaneously with the pressure, and, in an equal degree in all the gases; that each gas has, however, a different conducting power, or, in other words, a different capacity for transmitting heat. M. Guy Lussac, in employing large volumes of gas, did not find the same equality of specific heat which he obtained from smaller volumes.

Grafting.—The Philogeorgic Society of Naples has offered a prize of twenty-five sequins, to the author of the best paper on the following question: viz. "To establish, by facts, if the graft occasions any modification of the plant grafted; and *vice versâ*, if the plant exercises any influence on the organization of the graft; with respect to plants and grafts of the same, or of different species and forms." The prize is to be adjudged in the year 1829.

Negroes.—M. Roger, in his account of Senegambia, says, that the handsomest negroes are the Ghiolofs; and that they are Africans only in colour. The nose is regularly formed, and the hair is long. The facial angle, and the other physiognomical signs, which have hitherto been considered as the measure of the intelligence of the blacks, approach to those of Europeans.

Aurora Borealis.—A paper was read before the Royal Society, on the 17th inst. on the height of the Aurora Borealis above the earth, communicated by the celebrated chemist, Mr. John Dalton. From a comparative view of different observations made by himself (particularly on an aurora seen throughout the North of England, on the 29th of March, 1826), and by others, as recorded in the Philosophical Transactions and other scientific repositories, Mr. D. has been led to the conclusion that those luminous arches of the aurora which are usually seen stretching from east to west, are all nearly of the same height, and that height not more than 100 miles. Observations are still wanting for the determination of the length of the beams parallel to the dipping needle, which constitute the more ordinary forms of aurora borealis; neither has it yet been determined, whether these beams arise above the arches, as from a base, or whether they descend below, as if appended to the arches. It is remarkable, that the arches and beams are rarely, if ever, seen connected together or in juxtaposition; but always in parts of the heavens at a considerable distance from each other.

NEW PATENTS.

Nathan Gough, of Salford, Civil Engineer, for an improved method of propelling carriages or vessels by steam or other power.—20 March—6 months.

Samuel Clegg, of Liverpool, Civil Engineer, for certain improvements in the construction of steam engines, and steam boilers, and generators. 20 March—6 months.

MINOR CORRESPONDENCE.

A neighbour of our correspondent, "Vectis," will be obliged to any of our readers who are practically conversant with ornamental and useful iron work, to inform him where he can find any good published instructions for the setting of balconies, gates, railings, balustrades, &c.

Mr. Cox, in reply to "Inquisitor," p. 99, on Bees, states that the new plan of "taking the honey from the hive," recommended by him, but denounced by Inquisitor as destructive of the bees, has "been employed by two friends of his with success." We are inclined, notwithstanding, to think with Inquisitor, and for the reasons he has given, that the old plan is the best.

"Burin" is anxious to know whether the "Engine extraordinary," which we stated in No. 220, p. 224, had been announced in America, has been yet brought into action, or failed, "as he suspects it is constructed on the same principle with one which he has himself devised." We have not met with any farther notice of the project to which he alludes, in any of the recent American papers and journals.

Mr. N. J. Andrew remarks, with respect to the rule given by Vyse, for finding the area of a trapezium, and objected to by Mr. G. W. Wilson, (p. 279, vol. viii.), as incorrect, that it "gives the greatest possible area that can be contained by the given sides, or, which is the same thing, shows that the trapezium must be capable of being inscribed in a circle." (Vide "Hutton's Mensuration," large edition, or "Simpson's Fluxions"). C. K. observes to the same effect, that "had the words *when the trapezium can be inscribed in a circle* been added, the rule would have been complete, and given the exact area, according to Ingram, and other mathematicians."

Pump Question.—(See vol. viii. pp. 169, 217, 252, 278, 335, 364, 431.)—"H. Foord returns his grateful acknowledgments to Mr. H. Ottley, for his remarks concerning the Pump. An alteration has been made, by an enlargement of the feed-pipe, but H. O.'s hints came too late to be attended to when this was done. However, some friends think that no improvement would have been effected by the addition alluded to. H. O.'s opponent advises to bring the pump nearer to the stream, but this cannot be done, as the cistern must remain in its present situation, on account of its use in supplying a brewing copper, and other utensils in an elevated situation. A reservoir half-way, or some contrivance for raising the water by means of a double acting pump, seems to be the only efficient remedy; that is, a plan by which the water may be forced up the first half of the way, and sucked up (raised by means of a vacuum?) through the other half, at one and the same moment.

National Repository of Manufactures.—We shall reconsider our opinions on this point; but not till something farther is known concerning it. The discussion to which Reuben Godolphin invites us, had better be deferred.

INTERIM NOTICES.

Mr. Mackinnon's paper on falling bodies, is in type, but on account of length, deferred till next week.

Communications received from Mr. Brew—An Old and Cordial Friend—Mr. R. Evans—J. O.—Mr. Dakin—Messrs. Buckland and Smith—Mr. Harrison—Mr. J. P. Grellet—An Octogenarian—S. S.

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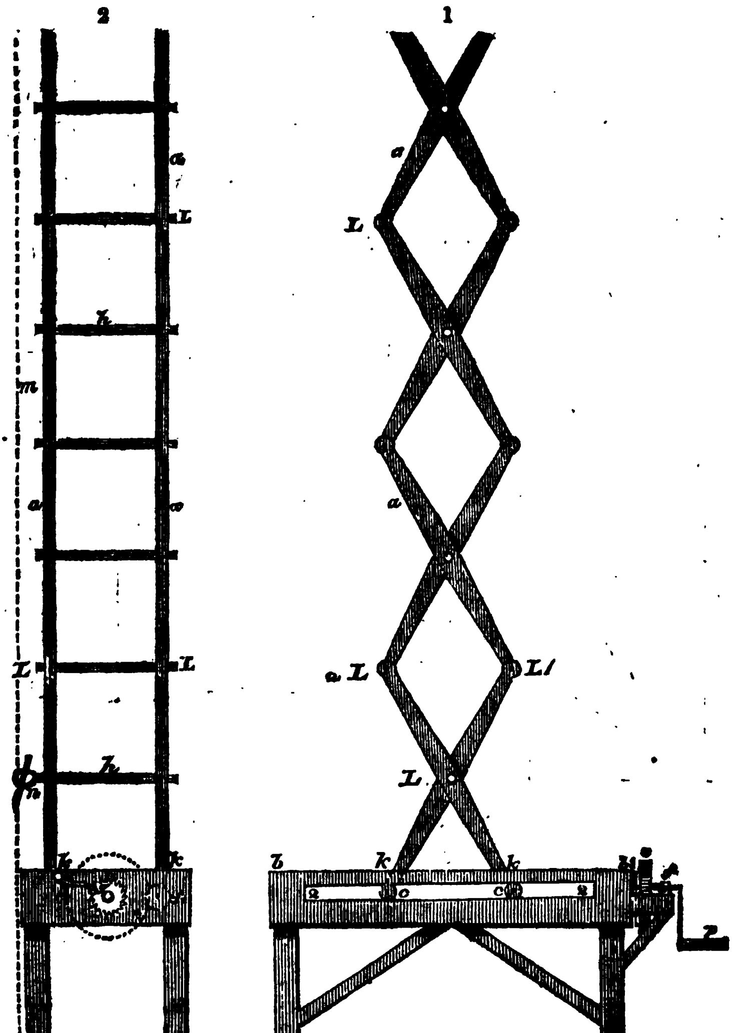
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 247.] SATURDAY, MAY 10, 1828. [Price 3d.

"The charms of nature, the majesty of man, the infinite loveliness of truth, are not hidden from the eye of the poor; but from the eye of the vain, the corrupted, and self-seeking, be he poor or rich." —*Edinburgh Review, No.* 92.

EXPEDITIOUS ELEVATOR.



EXPEDITIOUS ELEVATOR

For extricating Persons from Fire, and serving as a Scaffolding for Masons, Painters, &c.

Sir,—I beg leave to submit, for your inspection, a plan of a machine; but in the absence of practical information of its application, I am at a loss to say whether it would answer or not. How far it might be applied as a fire-escape, I leave for you and your correspondents to determine. I have not given any plan how a platform might be formed, and fixed on the top of the rods, as I consider that would be very easily accomplished, providing the apparatus were applicable to the purpose of a fire-escape.

Another purpose I presume the machine might be useful for, would be as a scaffold for the cleaning and colouring of ceilings and walls in entrance halls, cathedrals, &c., and other places of lofty dimensions.

You will perceive, on inspection, that the machine is capable of any elevation. I have only given you two elevations—side and end—showing the rods extended. Your readers will, I hope, understand what fig. 3 was intended for: it was no more than to show in what position the rods would be in when at the lowest elevation.

For the more readily conveying the machine from place to place, it might be advisable to mount the frame-work on four wheels. I shall now attempt a description, in detail.

Fig. 1 is a side elevation of the frame-work *b b b b*, and the rods *a a* extended, having joints as at L L L L.

Fig. 2 is an end elevation, showing how the two sides of the rods are connected by bolts *h h h*, &c.

Fig. 3 is a perspective view of the frame-work and machinery.

3

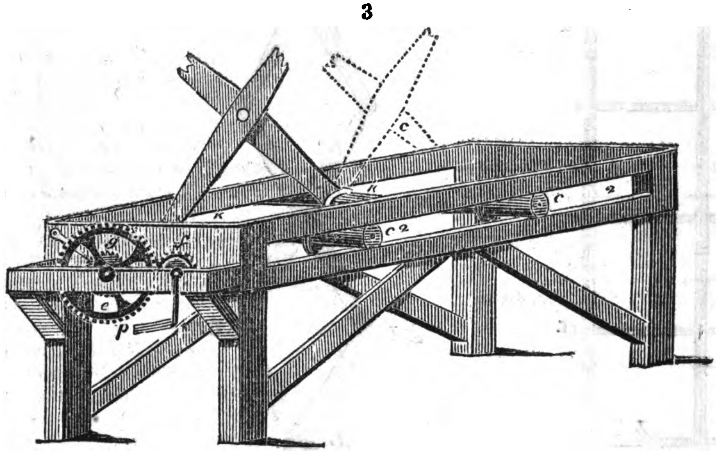


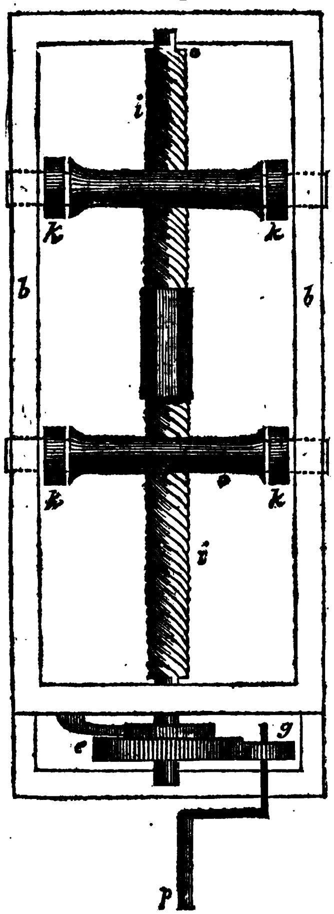
Fig. 4 is a plan of fig. 3. *i i* is a strong right and left hand screw, passing through the cross bars *c c* (see fig. 5); on one end of *i i* the wheel *e* is fixed; behind which is a ratchet-wheel *g*, to keep the rods at any proposed elevation; *f* is a pinion working in the wheel *e*; *k k k k* (figs. 4 and 5), is the place on which the rods *a a* are placed, with joints similar to L L (fig. 1).

Fig. 5 represents the cross bars, showing the place through which the screws pass *k k*, where the rods *a a* fix; and 1 1 are two friction rollers to work the groove 2 2 (fig. 3 and fig. 1.)

I think it will be clear, on inspection, that when the winch P is turned once, every round it will cause the screw to revolve, consequently will cause the cross bars *c c* to separate, and the rods *a a* will descend; give

the winch P a contrary direction, the cross bars *c c* will approach

4



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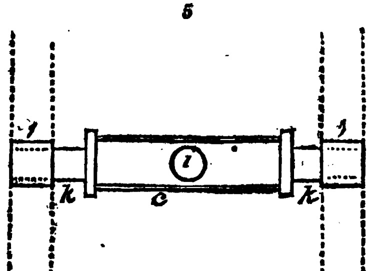


each other, and cause the rods *a a* to ascend. Taking the rods to be each five feet long, according to No. 1 elevation, four pair of rods would extend to thirteen feet and upwards, without the height of the frame.

Hoping that the description I have attempted may be clearly understood, and above all, that the machine may prove beneficial in extricating those of my fellow-creatures who may be unfortunately placed in the awful situation of being burnt alive,

I am, Sir,
Your obedient Servant,
A Member of the Richmond Mechanics' Institution, Yorkshire.

While laying the preceding paper before our readers, we think it but right to mention, that between two and three years ago a gentleman of Nottingham communicated to us, confidentially, that he had construeted a machine on precisely the same principle, and for the same purposes. We can well suppose, however, the notion of such a machine to have been a first thought with both individuals; and do not conceive that a general intimation by one person, that he had hit upon a particular invention, ought to be any bar to our giving publicity to an actual developement of it by another.

A machine constructed on the plan here described appears to us as likely to answer the objects in view as any one which has yet been proposed. It is free from the insurmountable obstacle which exists to the general use of such fire-escapes as Mr. Whitty's (recommended by our correspondent Mr. Baddeley, vol. ix. p. 213); namely, that every house must have one, on the vague chance (five hundred to one) that it may, some time or other, be needed.

Were one such machine as the present mounted on wheels, and placed in each watch-house, it could be hurled to any house on fire in a few minutes, and thus serve for a whole district. It presents also this superior advantage, that it could be worked by the persons having the charge of it, independently of any aid or co-operation from the persons

in danger; who are, in general, so bewildered and agitated as to be unable to afford any. It is not every person who has even nerve enough, in such situations, to make use of a ladder (such as Gregory's), when placed within their reach,—not many women or children, certainly. But here, all that would be necessary would be to step into the cradle, or hammock, or other receptacle of that description, which the machine would elevate to the windows of the house on fire.

We intended, when we had the pen in hand on this subject, to take the opportunity of clearing our file of several other communications we have received respecting it, by extracting as much of novelty as there is in each of them; but we find compelled, for want of room, to defer doing so till next week. The communications to which we allude are from Mr. Saul, Mr. Wansbrough, Mr. Brew, T. D., and J. O.

EXPERIMENTS ON THE COMPOSITION OF MORTAR.

Sir,—In the 204th Number of your most valuable publication, I find a receipt for the composition of mortar. Permit me to offer a few remarks on this subject, the result of many years' experience. In many places it is extremely difficult, in some impossible, to procure good clean sand of a siliceous nature; that which masons denominate sand, being often mixed with earth, or being only pulverized argillaceous stone; and in either case the mortar made with it will never stand the effects of moisture, frost, and time.

Having observed that lime always becomes very hard when mixed with glass, or any substance that has submitted to the action of fire, I have, for many years, insisted on my masons using only sifted coal-ashes as a substitute for sand, and not permitting a particle of what they consider as the latter, or of earth, to enter the composition of the mortar which they use in my walls; and when building stone-work, I direct them never to mix more mortar at one time than they are likely to use in the course of the day, as mortar soon sets, and when broken up never sets a second time so strongly as the first. By these means I find that the mortar never breaks or crumbles out of the joints of my stone-work, but every year becomes more hard and firm; whereas in many buildings that have been erected only a few years, and in which mortar made in the common way has been used, cracks and breaches take place, and the mortar falls from them, and from the joints, like mould, having quite lost its tenacity.

On examining the mortar which has been used in the construction of our old castles, which have been demolished only by the force of gunpowder, we shall find that it is full of cinders, brick, glass, and flinty pebbles, mixed with lime, and, probably, applied hot; by which means (and not, as has been supposed, by some art now lost) they acquired that strength and solidity we so much admire.

Brick mortar must, of course, stand some time before it is used; but this, when made with coal ashes instead of sand, will become so hard, that in many instances the brick will break before the joints will separate.

I am, Sir,
Your humble Servant,
E. B. C. G.

ON FALLING BODIES.

Sir,—Notwithstanding that some difference in opinion existed between some of your intelligent correspondents and myself, which required some explanation, I declined entering a second time into the discussion, conceiving that enough had been said to enable the carpenter to estimate the force of his machine. The subject, however, has been forced upon me by the disingenuous remarks of your correspondent "Glevum."

At page 230, vol. viii. Mr. G. says, "I will not dispute but what Mr. Barrat's solution may be as accurate as Mr. Mackinnon's; but I will humbly maintain that they are both equally wrong." Now, this is only

saying that two things that correspond in all their parts are, of necessity, equal. Now, Sir, whatever Mr. G. may assert to the contrary, I do maintain that the view taken of this question by Mr. B. and myself is in accordance with every treatise on mechanics which has appeared: but Mr. G. disclaims such authorities; for at page 355, vol. vii. he says, "that they rather tend to mislead than otherwise." The following extract from the "Encyclopædia Metropolitana" will, probably, have as much weight with your readers as the assertions of Mr. G.; while at the same time it will show that the force of percussion, as compared with pressure, is much greater than has generally been admitted. The writer, speaking of the power of the wedge, says, "Moreover, the power applied to the wedge is generally percussive, from the stroke of a mall or mallet; which, if it be not absolutely incomparable with pressure, at least involves much difficulty in the comparison, and the shock which it occasions produces effects in many cases perhaps totally different from what would be caused by any degree of pressure." And in a note to the above remarks, the writer says, "The writer of this article has been informed, that from the results of some experiments made in Portsmouth Dock Yard, in driving and pressing in large iron and copper bolts, a man of medium strength, striking with a mall weighing eighteen pounds, and the handle of which was forty-four inches long, would start a bolt about one-eighth of an inch every blow; *and that it required a pressure of one hundred and seven tons to press the same bolt down the same quantity;* but a small additional weight pressed it completely home."

According to the experiments of Mr. Bevan, the greatest velocity of a hammer—the head being of iron, and weighing one pound, and the length of the handle being forty-two inches—is stated at fifty-three feet per second. (See "Mechanics' Magazine," page 199, vol. iii.) Now, Sir, supposing the mallet of eighteen pounds to have the greatest velocity given by Mr. B., still it leaves all calculation far behind. I shall, therefore, leave it to Mr. G. to reconcile these anomalies, if he can.

Mr. G. says that I "admit, with great readiness, that a falling body passes through one hundred and ninety-three inches in the first second, in the latitude of London," and asks, "whether I have made the experiment?" To the above question I say, No; but if I had made the experiment, and having found it to agree with that of others, would Mr. G. give me more credit for accuracy than he does to the best writers on mechanics, whom he accuses of misleading us? Mr. G. now leaves me rather abruptly; I will, however, follow him. At page 117, vol. vii., Mr. G. says, "Mr. Lake's calculation, that 6 cwt. $\times \sqrt{20} = 6 \times 4{\cdot}47 = 26{\cdot}82$, the required force, although considerably nearer the truth, is not even in accordance with his own rule." Now, Sir, it is evident, from the above quotation, that Mr. G. understood Mr. Lake as giving a rule for finding the comparative forces of falling bodies; if not, how could he say that Mr. Lake's answer was considerably nearer the truth than that given by "Aries" for, according to "Aries," the effective force of the ram is 84 cwt.? But Mr. G. has, no doubt, been in a hurry, and we must excuse these slight deviations from accuracy.

Mr. G. now returns to me again, and acknowledges my ingenuity in answering his question. He admits that I am correct in theory; and therefore he concludes that I must be wrong in the practical application of it. (All very logical, to be sure!) This he attempts to demonstrate, by saying that an "engine 100 feet high would be useless." Nay, not so, Mr. G.; if you want the least possible effect, with the greatest loss of time and labour, you must make the engine much higher than 100 feet; but probably 100 feet will be sufficiently high to convince you of the truth of my answer to your question.

Mr. G. now takes up a new position, and says "his object was to

turn the attention of your correspondents to the best possible construction of a pile engine *for general purposes*. Truly, Mr. G. has a wonderful knack at shifting: his former question is plain and intelligible; but the question, as amended by him now, I call nonsense. I always thought that a pile-engine was for driving piles, and nothing else; but "Glevum" wants one that may be applied to some other purpose,—to drive his four lazy fellows, perhaps!

I now come to his postscript, which deserves a little notice. After quoting from my answer to his question, he exclaims,—"Now, only think, Mr. Editor, what fools practical men must be (must have been, I suppose is here meant) not to have found out this before." But is Mr. G. sure that they were acquainted with the facts stated by me? and, if they were, is he quite certain that none of them have acted on the principle recommended by me? "I accordingly ordered my foreman to substitute one of 20 cwt." &c. This is Mr. G.'s own invention, not mine, as he insinuates; and my admiration of his genius is such, that you will pardon me for applying to him the following beautiful lines from Milton:—

"Thine this universal frame, thus wond'rous fair!
Thyself how wond'rous then!"

I stated, that the labour of raising 4 cwt. sixteen feet, and 16 cwt. four feet, was equal; but that the momentum of 16 cwt. falling from a height of four feet is double that of 4 cwt. falling sixteen feet. I took my examples from his Table, in order to leave him no room for evasion, vainly hoping that there was at least *one scientific writer in whose decision he would acquiesce*. Mr. G., however, was not satisfied with the plan recommended by me, but he orders his foreman to load the four lazy fellows with 20 cwt. (not 16 cwt. as I recommended);—and what then? Why, the impudent fellow laughed at him; and well he might laugh, at such an absurd proposition.

I had written this far, when I received No. 227, wherein I perceive another solution to the question on pile-driving, by a correspondent at Tisbury. This correspondent, after quoting Mr. Barrat's rule, and also quoting from my answer to "Glevum's" question, says,—"Both gentlemen make the effect of the ram to vary according to simple force, whereas it is evident to me it ought to be measured by living force."

Your correspondent has not given a definition of what he means by "living force." I have always understood the expression to mean the cause of motion; and I must own that I cannot perceive what connexion there is between the cause of motion, and the effect produced. Your correspondent says, "*w a* will measure the living force." This is a mere assumption, without any demonstration. Your correspondent says, that "part of the foregoing is taken from 'Hutton's Mathematics.'" It is a pity that he did not content himself with giving us Hutton's solution entire, and not garble it, and mix it with his own; then we should have been better able to judge of its merits.

In No. 232, Mr. J. Utting takes up the pile-driving question; but as he does not differ in any respect from what has already been stated by Mr. B. and myself, I need not review his paper at large. There are, however, some remarks in his paper which deserve my notice. In the fourth paragraph, Mr. U. says,—"Mr. Mackinnon affects his surprise at the question proposed by 'Glevum,' and says the question has no maxima, or minima, but what are infinite," and concludes with a "!!" Now, I would ask Mr. U. what cause he had to wonder at my statement? Mr. U., it seems, can only look at one side of the question, and then makes his own blunder a matter of astonishment. I did not say, nor can the conclusion be drawn from what I said, "that the maximum effect takes place when the ram is in a state of quiescence." The question is a compound one, which requires the combination of the *greatest effect with the least loss of time*

and labour; and I maintain that I answered the question correctly, on the supposition that the effect is as the velocity. But if the above remark should not convince Mr. U. of his error, perhaps an example from his own Table will. By the Table, a fall of one foot gives a velocity of 8·021; also a fall of four feet gives a velocity of 16·042, which is exactly double of the former: hence the momentum being as the velocity, the effect will be doubled; and this is in accordance with the established laws of mechanism. But the labour of raising any body to the height of four feet is evidently four times that of raising the same body one foot; at least this has been always the mode of reasoning in the Old Light School. Therefore, the maximum effect combined with the least time and labour, is when the height of the engine is infinitely small.

Let me, also, tell Mr. U. that I did not affect, neither was I surprised at the question proposed by "Glevum;" but I certainly was surprised that "Glevum" should have been the proposer.

I have more to say upon this subject, but I fear I have already trespassed too far on your valuable pages.

I am, Sir,
Yours, &c.
A. MACKINNON.

FAST SAILING VESSELS.

Sir,—Having in my last answered, as far as in my power, the inquiries of "An Admirer of Naval Architecture," respecting the Asia and Ganges, I hope I may be allowed, in my turn, to ask a question or two.

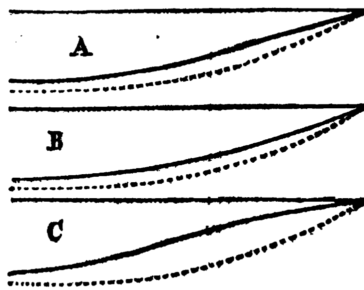
In vessels constructed merely for fast sailing, what should be the curve of the water-line from the stem to the midship section?

Should it be nearly a straight line, gradually reconciling with the straight amidships, as A?

Or should it be a convex curve of greater curvature, as B?

Or, on the other hand, a concave curve, C, which changes to a convex one?

The dotted lines are for the curve of the bow on deck, and the whole



are sharper than in practice; but that is no part of the present question. Such a bow as C, with concave lines abaft also, is a characteristic of some of our fastest yachts, as the Pearl, &c. Others, again, as some built at Cowes, have the form more like A, with their extreme breadth even as far aft as the runners; and B is an example of the old mode of construction. I shall be very glad to hear an opinion of their respective merits; and, should no one think it worth their while to discuss them, I will take some future opportunity of doing so.

I am, &c.
PHILO-NAUT.

P. S.—I believe that, some years ago, a vessel of very singular dimensions and form was built for the Royal Navy, at Mr. Bayley's yard, Ipswich. Should Mr. Bayley be able to give a sketch of this vessel, I take this opportunity of requesting information on the subject; as I observe that he has already sent to your pages several valuable contributions.

ALGEBRAIC QUESTIONS TO BE SOLVED BY SIMPLE EQUATIONS.

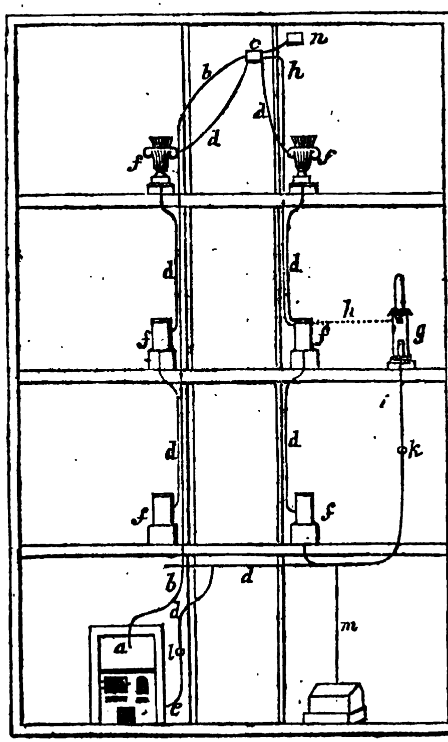
PROPOSED BY MR. MACKINNON.

First, $x^2+y^2=x^3-y^3$, and $x^2-y^2=x\,y$.

Second, $x^4-x^2y^2+x^3y-xy^3=405$, and $x^2+xy=45$.

Third, $\frac{x^3-y^3}{x-y}=151$, and $\frac{x^3+y^3}{x+y}=61$.

CHABANNES'S METHOD OF HEATING HOUSES BY HOT WATER.

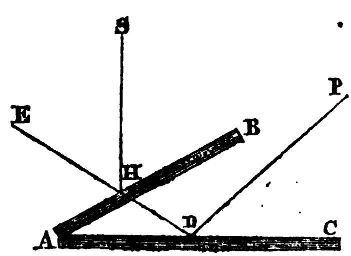


The above engraving represents the method which we mentioned in our last Number had been adopted by Count Chabannes, for circulating hot water through the different floors of the houses Nos. 36 and 37, Burlington Arcade. It will be perceived that the plan is one susceptible of universal application.

a is the kitchen fire-place, with a boiler behind the grate; *b* a pipe by which the hot water ascends into the parlour floor *d*, and continues from thence to the upper cistern *c*; *e*, extremity of the returning pipe, by which the cooled water returns to the bottom of the boiler; *f f*, vases of hot water in the three floors, supplied by descending pipes from the upper cistern *c*; *g* a stove, from which hot water may be made either to ascend or descend by the pipes *h* or *i*; *k l*, stop-cocks; *m*, pipe for supplying a bath; *n*, supply cistern of cold water to the whole.

IMPROVEMENT IN THE CONSTRUCTION OF HADLEY'S QUADRANT AND SEXTANT.

BY MR. WM. SHIRES, MATHEMATICAL TUTOR.



Let A B and A C be two polished plane mirrors, S a star, P a planet,

and E the place of the observer's eye. The plane A B being but half the breadth of the other A C, the incident ray P D, from the planet P, will reflect the ray D E to the eye at E, by the side of the plane A B; while the incident ray S H, from the star S, will reflect the ray H E to the eye at E, from the edge of the mirror A B; the plane being so placed, that the angle formed by the incident rays S H and P D may be double the angle B A C. From the nature of optics, the angle P D C is, therefore, equal to the angle E D A, and angle S H B to angle E H A; and they will jointly reflect the contact of both images in the direction D E to the eye at E, the planes being placed as above mentioned.

The above improvement has been found, in practice, attended with great ease and convenience.

W. S.

March 10, 1828.

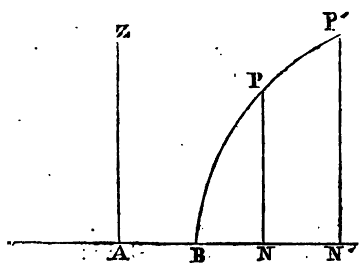
AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(*Continued from p.* 233.)

16. But though we have, by means of the preceding figures, obtained correct geometrical ideas and actual delineations of the respective fluxions of lines, areas, and solids, it remains to explain how this assists us in our measurements.

This is, perhaps, the hardest part of our task. A mere figure is of no use whatever in our calculations; we must express this fluxion by symbols, and call in algebra to our aid; and this will render it necessary for us to say a few words on the application of that science to geometry, and on equations to curves: but we may here remark, that it is by observing how the fluxion is obtained from the line, surface, area, or solid, or their symbolical representative, which is called the fluent or flowing quantity, that we are enabled to retrace our steps, and determine the fluent from the fluxion. The fluxion being a line, rectangle, or cylinder, is subject to rules which do not apply to the curve figure itself; it may be determined, when we cannot directly arrive at the fluent. But the fluxion being once obtained, we may attain our object by its interposition; for having previously observed how fluxions are obtained from fluents, we may, by reversing the operation, find the fluent from the fluxion.

17. To give some account, then, of curves, we must begin by premising, as indeed we hinted before, that all curves may be supposed to be traced by the extremity P, of a line N P; which moves parallel to its first position A z, along the line B E.



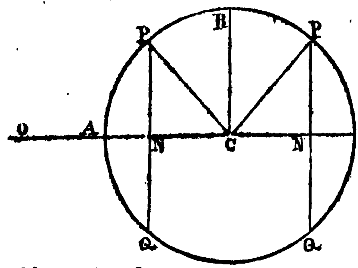
It is evident that the figure of the curve will depend on the magnitude which this line N P, assumes in each different position; or on the relation which subsists between the part A C, of the indefinite axis, which is intercepted between any fixed point A, which we may assume in the line A N, and the variable line N P; the portion A N, of this axis, which is thus cut off, is called the abcissa, from a Latin word *abscissa*, which means "cut off," and the variable line N P is called the ordinate: when we speak of the two lines A N N P together, and have no occasion to distinguish between them, we call them inordinates. This relation between A N and N P is called the equation to the curve, and may be found, when we know the way in which the curve is constructed or described mechanically.

The line A N is generally called x, and is measured first from left to

right; it is then called positive: when it is measured from A to the left, it is negative, and is represented by x.*

The line N P is called y, and is positive when above, and negative when below, the axis A N. The point O, from which we begin our measurement, is called the origin of the curve.

18. Suppose C to be the centre



of a circle, O the origin, or point from which we begin to measure (and first let it be out of the circle); join O C, and produce it indefinitely. Since the points O, C, are given, their distance is known; let us call it a, and let r be the radius C P of the circle. Then O N being x, and N P y, we have C N $= a-x$. And since $CP^2 = CN^2 + NP^2$ (by Euclid), by putting for C P, C N, and N P, their algebraic values r, $\overline{a-x}$, and y, we have

$$r^2 = \overline{a-x)}^2 + y^2$$

or, $r^2 = a^2 - 2\,a\,x + x^2 + y^2$;

$\therefore y^2 = 2\,a\,x - x^2 + (r^2 - a^2)$, which is the equation to the circle. If, in this case, $a = r$, or O, the origin of the curve, be in the circumference, then the equation becomes $y^2 = 2\,x - x^2$.

Suppose O coincides with the centre C, then O C, or $a = o$, and the equation becomes $y^2 = r^2 - x^2$. Hence, arranging our results, we have for an equation to the circle,

(1.) When the origin is out of the circle, $y^2 = 2\,a\,x - x^2 + r^2 - a^2$.

(2.) When in the circumference, $y^2 = 2\,r\,x - x^2$.

(3.) When the centre is the origin, $y^2 = r^2 - x^2$.

(To be continued in our next.)

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* It may easily be proved, that if a line measured in one direction be positive, it must be negative when measured in the opposite direction.

For let N, A N, be a straight line. Call A N x, A B a. Then

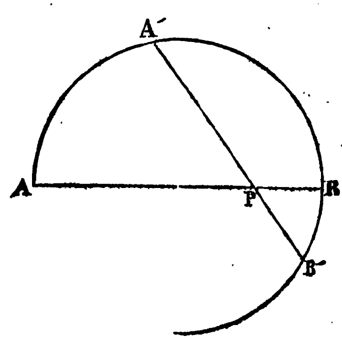
B N, which is measured from B $= x$ $x - a$, which is positive.

Now, suppose the point N to move up to M, the line B M is measured in the direction opposite to B N, and is equal to $\overline{x-1}$, which, since x is now less than a, is clearly negative.

PROBLEM ILLUSTRATIVE OF THE SEPTENARY SYSTEM.

Sir,—The System of Mr. Jopling has suggested to me the idea of proposing to your readers the following problem:—

Draw a semicircle; and suppose the diameter or chord of that semicircle to move round a point P, so that one of the extremities A A′ shall follow the circumference of the circle; what will be the curve engendered by the other extremity B B′ of the diameter?



I submit this problem to your readers; and I will demonstrate (if necessary) that the curve engendered is an epicycloid.

I am, &c.

F.

NEW AND OLD STYLES.

Sir,—I beg leave to submit to your readers, for solution, a ques-

tion which has excited some interest in the family of which the subject of it is the parent.

Suppose a person born on the 3d of February, 1751, O. S.

Query,—What will be his age on the 14th of February, 1828, N. S.?

On perusing this question, it will, at first sight, appear he is 77 years of age, at the time above alluded to, but, in my opinion, he is not so old.

J. P. GRELLET.

Norton Falgate.

N.B. I should be obliged to any of your readers to explain satisfactorily the above mentioned person's true age; as he keeps his birthday on the 3d of February, N. S., and also affirms he was 77 years old on that day last.

EXTRACTING SQUARE ROOTS.

Sir,—The rule given in No. 234 of your Magazine will be rendered more serviceable by the following method for obtaining the square of any number:—

Rule.—Take its difference with its nearest less root, ending in 0, or *blank* root; multiply double the blank root by said difference, adding the square of that difference; to this number add the square of the nearest less blank root.

Example.—Required 27^2. Then $40 \times 7 + 7^2 = 329$. Adding 400, we have 729, *Ans.*

We may find the square of two or three times a known square, multiplying the known square by 2^2 or 3^2. *Exam.*—$25^2 \times 2^2 = 50^2 = 2500$.

We may find the cube of two or three times a known cube in like manner, using 2^3 or 3^3 for 2^2 or 3^2. The square of any number being the product of two whole numbers, = the product of their squares. Required the difference of two nearest cubes in succession. Double the triple root, adding or subtracting 6; let 6 be added to, or subtracted from, the last found difference for the next difference. Hence the rule before given may be rendered applicable to the extraction of cube roots and square roots.

I am, Sir,

Yours, &c.

G. S. L.

NEW PUBLICATIONS

Connected with the Arts and Sciences.

[A portion of each No. will, in future, be regularly devoted to this department; an arrangement by which we hope to bring more effectually under the notice of our readers, than can be done by occasional notices, the merits of the many new productions which are now more frequently than ever making their appearance on the various branches of the Arts and Sciences.—EDIT.]

Magazine of Natural History, and Journal of Zoology, Botany, Mineralogy, Geology, and Meteorology. Conducted by J. C. LOUDON, F.L.S. No. I. May 1828. 96 pp. 8vo. With numerous Wood-cuts. 3*s*. 6*d*.

The present undertaking, by our able and indefatigable cotemporary, Mr. Loudon, may be considered as but completing a design which the "Gardener's Magazine," excellent as it is, only imperfectly embraced. "Zoology, Botany, Mineralogy, Geology, and Meteorology," have all, more or less, a bearing on the pursuits of the gardener, and have had all, more or less, attention paid to them in the pages of the "Gardener's Magazine;" yet, from the degree of subordination in which they have been necessarily kept to the main purpose of disseminating improved modes of cultivation, those to whom the former are objects of superior interest, were still left much to desire. By the publication, therefore, of a new periodical, devoted as prominently to Zoology, Botany, &c. as the "Gardener's Magazine" is to gardening, Mr. L. has judiciously resolved to place the whole circle of sciences connected with external nature under equal obligations to his intelligence and industry. The "Magazine of Natural History," in short, is a much wanted and most worthy companion to the "Gardener's Magazine;" and, as such, is printed exactly in the same form, and is to be published alternately with it, once every two months. *First* numbers

of new periodicals are oftener failures than otherwise; not so with the present, which is, in every respect, such as to warrant us in saying, that if all the succeeding numbers are only nearly as good, the "Magazine of Natural History" cannot fail to have a long and prosperous existence.

Part I. consists of eight clever original communications on the Study of Natural History—the Obstacles which have retarded its progress in Great Britain—the Simia Jacchus, or Mamozeet Monkey—the Mangouste—the Kingfisher—the formation of a National Museum of Shells (more fanciful, however, than useful)—the Jussieuan System of Plants—and the principal Forest Trees of Europe, considered as elements of landscape.

Part II. comprehends an able review, by Mr. Swainson, F.R.S., of "Audubon's Birds of America," a work of unusual magnitude and splendour; and Analytical Notices of about a dozen other publications, interesting to naturalists.

Part III. is a "Collectanea" of "Facts, Descriptions, and Speculations," relating generally to Natural History as a science, rather than to its progress in any particular place or country.

Part IV. includes, under the head of "Miscellaneous Intelligence," all such matters as may be called "News," or "Notices of local and temporary interest," both domestic and foreign. Each of these departments, we ought to add, is illustrated, even to profusion, with handsome wood-cuts, by Branston, from engravings by Sowerby and Harvey.

The number altogether is excellent; exhibiting everywhere proofs of great industry, judgment, and good taste, and a command of resources, limited only by a determined exclusion of every thing spurious or frivolous.

Popular Lectures on the Steam Engine; in which its Construction and Operation are familiarly explained: with an Historical Sketch of its Invention and progressive Improvement. By the Rev. Dionysius Lardner, LL.D., Professor of Natural Philosophy and Astronomy in the University of London, F. R. S. E., &c. pp. 164. 12mo. with 12 Plates.

The present work is stated by the author to be "principally designed" for "that part of the public in general, who, impelled by choice rather than necessity, think the interest of the subject itself, and the pleasure derivable from the instances of ingenuity which it unfolds, motives sufficiently strong to induce them to undertake the study of it." He professes, accordingly, to treat "familiarly" of "the general principles of the construction and operation of steam engines, rather than of their practical details;" and passes over wholly "many particulars which, however interesting and instructive to the practical mechanic or professional engineer, would have little attraction for the general reader." And hence the term "popular," by which, in contradistinction to other publications on the same subject, these "Lectures" are designated.

We regret that we cannot award Dr. Lardner the praise of which he seems to have been chiefly ambitious in the present attempt. We see nothing, in his account of the steam-engine, which could justify us in recommending it as either more "familiar," or more adapted to "popular" comprehension, than the other descriptions already before the public; while, from the nature of the plan on which it has been compiled, it is necessarily more incomplete, and of less practical use than any of them. As far as it goes, it is as overloaded with technicalities as the worst of its predecessors; and where it does make shorter work of any thing, it is simply by the convenient process of omitting it altogether.

An Introductory Lecture is devoted to a discussion of the "natural forces which are engaged in different modifications of the steam-engine." A considerable portion of this lecture is occupied in establishing, irrefragably, such novel truths, as that air is not only "a body," but "one of considerable weight" (a statement which Dr. L. expects will at first "excite some surprise!")—that fluids press equally in all directions, &c. After these come some other statements, fully as novel, but, in our humble opinion, not quite so well established. It is said (p. 10) to be "*true of all substances*," that their bulk is increased by heat, and diminished by cooling; the law is said to be an "*universal*" one, and no exception whatever to it is mentioned; whereas, every preceding philosopher, since the time of the Florentine academicians, has been at pains to show that water (the element of greatest consequence, in Dr. L.'s investigations) is *not* diminished but increased in bulk, by a diminution of temperature. Then we are told (p. 12) that water is an "*inelastic* fluid," though it was but the other day that the Society for the Diffusion of Useful Knowledge declared

the contrary to be "so plainly proved, by every day's experience, and by simple facts, as to occasion some wonder at the contrary having ever been asserted"—(*Treatise on Hydrostatics*, p. 2). We are farther informed (p. 13), that the various effects of caloric "may be *very satisfactorily* accounted for, by supposing that it is a substance, or a cause imparting to the corpuscles of bodies a repulsive force, by which they acquire a tendency to repel each other." From this curious hypothesis we have several most curious deductions. One is, that when the primitive tendency of bodies to cohere, and the tendency of caloric to make them repel each other, are nearly equal, or "nearly neutralize each other," the product of their near neutrality is "a liquid" (p. 14); that is to say, that a liquid,—water for example,—may be *philosophically* and "*very satisfactorily*" (!!!) defined to be a multitude of corpuscles, not exactly cohering together, nor yet decidedly repelling each other, but somehow or other generated by the near neutralization both of cohesion and of repulsion!!! Another is, that the expansive force of steam consists in the corpuscles of which it is made up so repelling each other, that they tend "to burst any vessel in which they may be confined" (p. 15); or, to speak "familiarly" and "popularly," they quarrel so, that one house cannot contain them. Dr. Black, the first great authority on the subject of heat, did suppose that heat was "a substance," and so have many able philosophers since his time; but we have no recollection of any person, before "the Rev. Dionysius Lardner, LL.D., Professor of Natural Philosophy and Astronomy, in the University of London," &c., explaining in so odd and jargon-like a style, the different modes in which this said substance operates. It is evident, that had Dr. L. been aware of, or rather, we should say, adverted to, the single fact before-mentioned, namely, that water is increased in bulk by the diminution of its temperature,—he would never have promulgated such corpuscular speculations as these. Were it by a repulsive action of the particles of bodies that bodies expand; and were heat the source of this repulsive action, how could it possibly happen, that where there is *no heat*, expansion takes place?

Dr. L.'s second lecture introduces his readers to the History of the Steam Engine. He observes, truly, that "it is not the exclusive" invention of any one individual, but "a combination of inventions, which, for the last two centuries, have been accumulating." "When we attempt," he continues, "to trace back its history, and to determine its first inventor, we experience the same difficulty as is felt in ascertaining the head of a great river; as we ascend its course, it becomes difficult, if not impossible, to distinguish it from its tributary streams, and it terminates in a number of threads of water, each in itself so insignificant as to seem unworthy of being called the source of the majestic object which has excited the inquiry."—A beautiful and appropriate simile, the merit of which would not have been lessened by an honest acknowledgment that it is borrowed, almost literally, from the first page of "Stuart's Anecdotes of Steam-Engines."

"The use," says Dr. L., "of the *elastic* force of steam, as a first mover, in a machine designed for raising water, *was first proposed* by Edward Somerset, Marquis of Worcester, in a work, entitled 'A Century of Inventions,' published in the year 1683." Dr. L. would never have hazarded such an assertion, had he investigated, as he ought to have done, the history of the invention about which he has undertaken to instruct the public. There is the clearest evidence in the world, that steam was not merely *proposed* to be employed as a first mover, but actually applied for that purpose by several persons, of different countries, long before the Marquis of Worcester existed. To say nothing of the attempts of Hero of Alexandria, Baptista Porta, Decaus, and Branca, we need only refer to the remarkable fact brought to light about two years ago (though recently revived in the "Foreign Review," and repeated in "The Times" and other newspapers, as quite a new discovery), that as early as 1543, (140 years before the publication of Worcester's "Century of Inventions,)" Blasco de Garay, a Spaniard, patronised by Charles the Fifth, actually exhibited, in the harbour of Barcelona, a vessel propelled by means of a steam-engine of his invention.—(See North American Review, 1827; Mech. Mag. No. 180, for Feb. 18, 1827.)

"We have no evidence, however," Dr. L. goes on to say, "except his own statement, that he (the Marquis of Worcester) ever constructed the machine, or made the experiments above described." Yes, there is other evidence—the evidence of Cosmo de Medicis, Grand Duke of Tuscany, who visited England in 1669, and who, in the

published account of his Travels, states that he saw, on the 28th of May, 1669, at Vauxhall, a hydraulic machine, invented by the Marquis of Worcester, which raised water "more than *forty* geometrical feet, by the power of one man only;"—a description which agrees exactly with what the Marquis himself stated of his machine in the "Century of Inventions," namely, that "one vessel of water, rarefied by fire, driveth up *forty* of cold water; and *a man* that tends the work has but to turn two cocks," &c. The Grand Duke, it is true, does not make mention of *steam* as the prime mover, but every mechanic knows that such effects as he describes could not have been produced by any other agent.

Captain Savery, the next great speculator in steam, is allowed by Dr. L. to have had the merit of first exhibiting, in practice, a combination of the elastic force of steam with the force gained by the formation of a vacuum through the condensation of steam; but, as far as invention goes, he pronounces this to be the extent of Savery's claim. "All the beautiful contrivances," he says, "by which this vast power is applied, regulated, and economized, are the result of the ingenuity of their (Worcester and Savery's) successors; and the engine suggested by Worcester, and that constructed by Savery, will be found to have scarcely anything in common with those of the present day, except their first mover." (p. 37.) A more erroneous estimate of the services rendered by Savery to the steam-engine could not well have been pronounced. So far is it from being true, that Savery's engine possessed "scarcely anything in common with those of the present day, except their first mover," that it has, on the contrary, formed the ground-work of the greater part of the improvements which have subsequently taken place, and a finger-post to all the rest. It may, indeed, be with safety asserted, that but for what Savery did—but for the machine, rude though it was, which he bequeathed for improvement to "the ingenuity of his successors,"—the name of Watt (to whom Dr. L. of course chiefly alludes) would never, in all probability, have been known in connexion with the steam-engine.

Of the merits of Newcomen and Cawley, Dr. L. gives a fair enough account: he describes them, with truth, as introducing no new principle, and being indebted to accident for the chief improvements they effected.

To the ingenious Frenchman, Papin, Dr. L. is decidedly unjust. Adverting to an engine which he constructed for the Elector of Hesse, in 1707, in which the expansive power of steam only was employed, he treats it as "scarcely meriting notice, were it not that it forms the ground on which the French claim the invention of the steam-engine." Now, though it is true that Papin did not, in the engine alluded to, realize any thing worthy of particular notice, he has other claims than that to respectful remembrance. He was the author of many ingenious and useful speculations on steam, and other subjects akin to it; and had the houour of being the first who pointed out that means of gaining power by the condensation of steam, the successful application of which, in practice, has gained for the name of Savery so much renown. Papin promulgated this principle, in a collection of Essays which he published in 1695. Savery first exhibited a model of an engine on that principle, before the Royal Society, in 1699. So far, however, was Papin from arrogating to himself the invention of the steam-engine, on the ground of the engine which he afterwards constructed on the principle of expansion, for the Elector of Hesse, that, in the description which he has left us of that engine, he acknowledges with candour the different nature of Savery's combinations, and does not even appear to question their perfect originality. Neither is it on the ground of the Hessean machine that Papin's countrymen claim for him the invention of the steam-engine, but on the fact (a narrow ground, we allow), that he was the first to suggest the principle of condensation, without which the steam-engine would be deprived of much of its importance and utility.

Of Sir Samuel Morland, of Hautefeuille, of Amontons, of Blakey,—all names of more or less material importance in the early progress of the steam-engine,—Dr. L. takes no notice whatever; and thus it is, that we have here the spirit of history *condensed* for "popular" uses.

Mr. Watt's numerous improvements on the engine are described at length, and with sufficient accuracy; but valuable beyond all example as these improvements were, they furnish no warrant for asserting, as Dr. L. does, that "*all* its great and leading perfections—all those qualities by which it has produced such wonderful effects on the resources of these countries, by the extension of manufactures and commerce," &c. (p. 98)—are owing to "the predominating pow-

ers" of this single individual; an assertion, by the bye, directly in the teeth of the fact, with the ennunciation of which Dr. L. set out—namely, that the steam-engine (as it now exists) was "*not* the exclusive invention of any *one* individual," but a "combination of inventions, which, *for the last two centuries, have been accumulating.*" It was not *Watt*, for example, who applied steam power to one of its most important purposes—*navigation.* Nay, strange to say, when it was hinted to him that it was susceptible of such an application, he smiled at the project as an idle dream.

In a lecture which Dr. L. devotes chiefly to this subject of steam navigation, he passes over wholly unnoticed the names of the individuals who have the best title to be remembered in connexion with it—Miller, Bell, and Fulton. We can excuse his making no mention of the first steam navigator, Blasco de Garay, since the claims of that individual are but of recent discovery, and not yet generally known; but the other names we have mentioned—that of Fulton, in particular—are in every mouth.

Among other branches of the subject, which Dr. L. treats with similar neglect, are the rotary and the tubular engines (respecting neither of which is there a single word); the general employment of steam power, on rail-ways, in the coal districts; and its projected application to the propulsion of carriages on roads of all sorts;—the two latter "popular" enough topics, it must be confessed, although not thought worthy of any notice in the "Popular" Lectures before us.

Dr. L.'s work is altogether, in short, a book of defects and blunders; neither embracing all that it ought to have done, nor, as far as it goes, distinguished either by correctness of information or by any peculiar felicity of description.

We regret that the Professor of Natural Philosophy in the New University should have chosen this sort of essay to introduce himself to the knowledge of the London Public. He has not done justice by it, either to his own talents, or to the judgment of the enlightened individuals who have selected him for that important office. Dr. L. had previously made himself favourably known to men of science by several Mathematical Treatises of great merit, and should not have risked his growing reputation on a production so hastily got up (to all appearance), and so much beyond the reach of his information and experience, as the present.

MISCELLANEOUS NOTICES.

Interior of the Earth.—M. Cordier, Professor of Geology, Paris, in a paper published in Professor Jameson's Journal, adduces a number of very plausible facts in support of the theory of an interior heat existing in the interior of the earth. He calculates that the external crust, upon which we stand, may be from 50 to 100 miles in thickness, and that beyond this, all within is a molten mass. He is farther of opinion, that the entire globe consisted originally of such a molten mass, the outer part of which became solid first, by throwing its heat into the regions of free space; that by the continual escape of heat in this way, the solid crust is constantly thickening; that the earth, in short, is a *cooled star*, which has been extinguished only at its surface.

Delicate Thermometer.—An ingenious addition to the ordinary thermometer has been proposed by a Mr. M'Gough. It consists in suspending an ordinary thermometer tube by a fine line or hair, so as to hang horizontally, when the temperature is at the freezing point. Consequently, when heat is applied to the bulb, the thread of quicksilver being driven up the bore of the tube, the equilibrium will be destroyed, and the tube take an inclined position. By suspending the tube so as to form the centre of a graduated arc (similar to the *protractor* of a set of mathematical drawing instruments), it is easy to conceive that a very sensible thermometer may be constructed. The tube becomes, in fact, the index of the mercurial expansion, and the sensibility of the instrument will, of course, be in proportion to the radius of the arc.

The Nautilus has many enemies, and among others, the trochus (or boys' top, which it resembles), who makes war upon it with unrelenting fury. Pursued by this cruel foe, it ascends to the top of the water, spreads its little sail to catch the flying breeze, and rowing with all its might, scuds along like a galley in miniature, and, by the exertion of its nautical talents, endeavours to escape its more cumbrous pursuer. Sometimes, however, all will not do; the trochus nears and nears, and escape appears impossible; but then the little animal, with inexplicable ingenuity, suddenly and secretly extricates itself from its tortuous and fragile dwelling, and which, when the trochus perceives, he immediately turns to other prey. The nautilus then returns to tenant and repair its little bark; but it too often happens, that before it can regain it, it is, by a species of shipwreck, dashed to pieces on the shore.—*Mag. of Natural History.*

Zoological Gardens.—We have already noticed the grant of land and water made by Government for the formation of a Zoological Establishment in the Regent's Park. It now appears, from a Report made to the Zoological Society at their last meeting, that upwards of two hundred living animals, most of them of great rarity, have been already collected, exclusive of a considerable number of wild fowl and gallinaceous birds. Arrangements are making for shortly opening the gardens to the public, at a shilling a head, during particular days of the week.

Northern Scientific Expedition.—Professor Hanstein was to set out about this time, on a journey to Siberia, accompanied by a naval lieutenant of the name of Due. At Petersburgh they will meet Dr. Erman, from Berlin, who is to go with them as naturalist and astronomer. They will proceed from St. Petersburgh to Moscow, Kasan, and Tobolsk, and northwards along the Obi to Beresow, in order to examine the hitherto imperfectly known northernmost branch of the Ural chain, and to observe the temperature of that tract. They will afterwards go from Tobolsk

by way of Tara, Tomsk, Krasnoiarsk, and Nischnei-Udinsk, to Irkoutsk, where they hope to arrive in time to pass the winter. Hence they mean to travel north-east to Jakoutsk, from which the most fatiguing part of the journey will be to Ochotsk, as there are 1014 wersts (676 miles) to go over, in a country entirely uninhabited, in which they must pass, perhaps, a thousand streams, bivouac in the night, and take provisions for the whole journey. It is calculated that the tour may occupy two years. The grand object of this important expedition is to observe the phenomena of magnetism, and to ascertain, if possible, the situation of the magnetic poles, &c.

The Elastic Curve.—A paper was read before the Royal Society, on Thursday, April 24, containing an account of experiments on the elastic curve, by our correspondent Mr. Bevan. In inquiries on the strength of materials, it is often desirable to know the real nature of the curve assumed by a prismatic rod, when acted upon by the weight of its own parts. This curve has generally been stated to be the parabola; but repeated observation has led the author to doubt the accuracy of the theory from which this conclusion has been deduced; and with a view, therefore, to determine, by direct trial, the real form of the curve, he instituted a series of experiments on prismatic rods, of various substances, and of various depths and lengths—some fixed at one end, and others supported at both ends, in a horizontal position. In every instance he found the actual curve to differ from a parabola, and the deviations in the several points examined, were such as indicated a regular and determinate species of curve. No modification of the exponent of the order of the parabola was adequate to express the relation of the co-ordinates with sufficient accuracy in all cases. He found, however, after many trials, that the following formula, which is that of the common hyperbola, gave a very near approximation in all practical cases, namely,

$$Ax^2+Bx=y^2$$

The accurate determination of the elastic curve is a subject of some importance in practical mechanics; since the rules at present used by mathematicians and engineers, for determining the modulus of elasticity of different materials, are founded upon the parabolic theory, and must, therefore, be liable to error.

Lapland Glue.—The bows of the Laplanders are composed of two pieces of wood, glued together; one of them of birch, which is flexible, and the other of the fir of the marshes, which is stiff, in order that the bow, when bent, may not break; and when unbent, it may not bend. When these two pieces of wood are bent, all the points of contact endeavour to disunite themselves; and to prevent this, the Laplanders employ the following cement. They take the skins of the largest perches (it is probable eel-skins would answer the same purpose), and having dried them, moisten them in cold water until they are so soft that they may be freed from the scales, which they throw away. They then put four or five of these skins in a rein-deer's bladder, or they wrap them up in the soft bark of the birch tree, in such a manner that water cannot touch them, and place them, thus covered, into a pot of boiling water, with a stone above them, to keep them at the bottom. When they have boiled about an hour, they take them from the bladder or bark, and they are then found to be soft or viscous. In this state, they employ them for glueing together the two pieces of their bows, which they strongly compress, and tie up until the glue is well dried. These pieces never afterwards separate.—*Trans. Stockholm Academy of Sciences.*

NEW PATENTS.

L. W. Wright, Surrey, Engineer, for improvements in the construction of wheel carriages, and in the machinery employed for propelling, drawing, or moving wheel carriages. 15 April—6 months.

Edward Cowper, of Lambeth, Gent. for certain improvements in cutting paper. 26 March—6 months.

MINOR CORRESPONDENCE.

A correspondent who takes for his signature one of the middle letters of the alphabet (we wonder he did not call himself a *constant reader*), complains lustily, that we have *not* inserted a vindicatory letter of his, which *was* inserted three or four weeks ago.

National Repository.—By a mis-print in last week's number, our notice on this subject was made to smack very much of nonsense. What we meant to say was, that we should re-consider our opinions about it, but that "till something further was known concerning it, the discussion to which Reuben Godolphin invites us had better be deferred;" that is, that until the mode in which the proposed establishment is to be conducted is better developed, it would be premature to enter into any farther discussion of its merits. We still deem this the course which prudence prescribes, and shall not be driven from it by the taunts of R. G.

The Aërial Carriage.—"W. C. in treating of the aërial carriage, seems to me to have fallen into an error from not calculating justly the loss of power arising from having a moveable fulcrum. He calculates that a man is able to raise 300 lbs. 20 feet high in a minute, or that he could cause the vanes to revolve with such a velocity as should be equivalent to that. But though he could do either of these separately, to suppose him raising such a carriage at such a rate, is to suppose him to do both at the same time, which would require the strength of two men; and, therefore, whilst the strength of only one man was employed, the velocity would be only half what is stated by W. C."—*J. Barnard.*

We agree with "Georgius," that when the discussion on lightning conductors took the personal turn it did, it was well dropped for a time; but that it would be a pity, should a subject of so much interest and importance "not be resumed in cooler moments, and the doubts of numbers respecting it resolved." There is a paper by Dr. Hare on the question, in a recent Number of Professor Silliman's Journal, for which we shall endeavour to find a place soon.

INTERIM NOTICES.

S. Y.'s rejoinder to Mr. Deakin in our next.

We have a rod in pickle for Mr. Dubois, on the subject of the Ancients, but have been waiting for Mr. D.'s promised continuation.

Communications received from T. B.—Mr. Brew—W.—The Cottage in the Fields—Matteus—C. S.—Projector—F.

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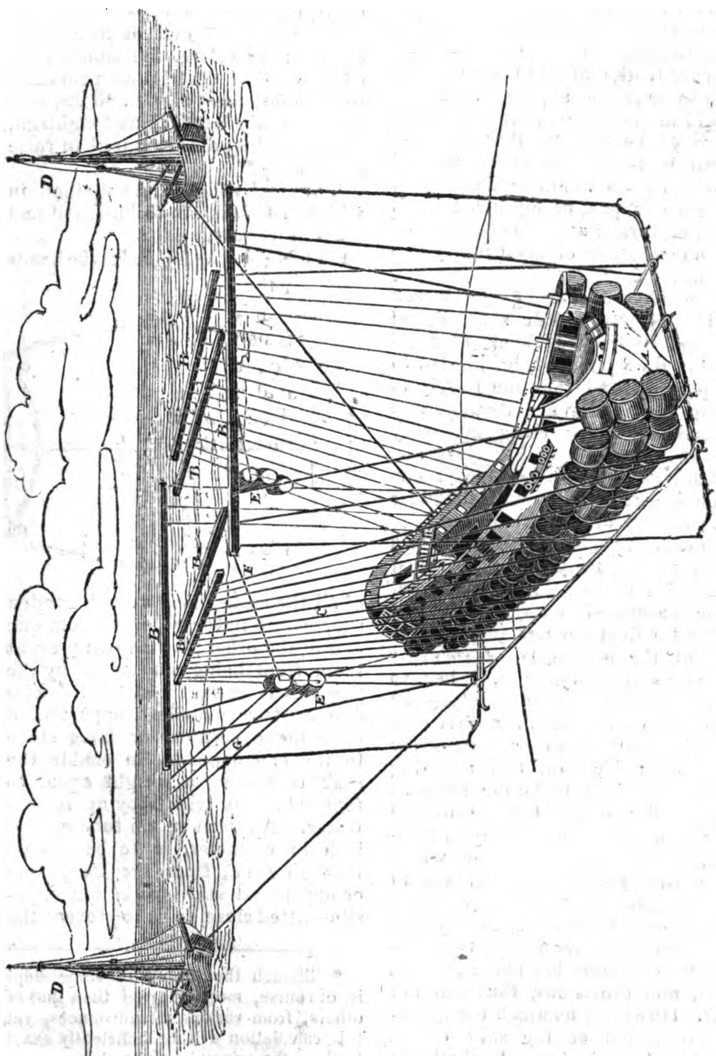
No. 248.] SATURDAY, MAY 17, 1828. [Price 3*d.*

"If excellence be never granted to man but as the reward of labour, a history of failures will invariably shorten the road to success."—DAVY.

PLAN FOR RAISING SUNKEN SHIPS



A PLAN FOR RAISING SUNKEN SHIPS.

BY JOHN PHEPOE, ESQ. LIEUT. R. N.

In forming the following plan for raising sunken ships by means of empty casks, or deal spars, according to circumstances, I have been actuated by a desire of benefiting the public, and more particularly His Majesty's naval service, to which I have the honour to belong. I trust, therefore, from the flattering encouragement I have already experienced, the attempt may meet with some little approbation; and should my humble endeavours ever prove of benefit to that service, which is England's bulwark, and in which I am proud to have spent the greater part of my life, I shall consider myself amply rewarded by the approbation of my countrymen and friends.

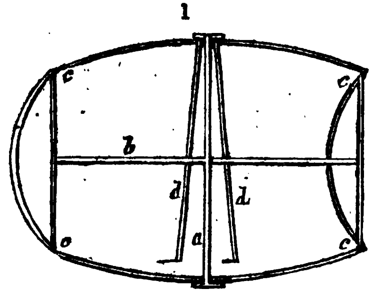
The idea of raising the wreck of His Majesty's late ship, Royal George, which was sunk at Spithead in the year 1782, having led to the plan, I shall take the liberty of giving the reader a statement and estimate of every thing necessary for raising a ship of her class and dimensions, sunk under similar circumstances; which will likewise serve for any other ship or vessel.

In order to raise a ship of the said class, immediately after her loss, before her timbers have time to become saturated with water, and where the depth is not too great to prevent the possibility of securing the casks from bursting, I beg to observe, that having ascertained the quantity of timber in a first rate line-of-battle ship to be about sixty thousand cubic feet, and allowing the dead weight to be the same as was in the Royal George at the time of her loss—about eleven hundred tons—nine hundred of which being iron and copper, includes all her ballast, guns, shot, anchors, copper on her bottom, bolts and small arms; the remaining two hundred tons includes her cables, stores, coals, and provisions, that will not float. However, as much the greatest proportion of the said eleven hundred tons is iron, I shall, in forming my estimate, consider the whole as such; and as I find by experiment, that one cubic foot of well seasoned oak will, upon an average, buoy up twenty pounds of iron; consequently, sixty thousand cubic feet—the quantity in the ship—will buoy up 535 tons, 14 cwt. 32 lbs.; of course there remains 564 tons, 5 cwt. 80 lbs.—the actual weight to be raised. I find also by experiment, that one leager will buoy up, in the water, 27 cwt of iron slung outside; therefore, the number of casks of that description necessary to raise 564 tons, 5 cwt., 80 lbs, will be about four hundred and eighteen,—the number, also required to raise a first rate.*

The following is the method in which the casks are to be fitted and secured from bursting:

Fix a ledge *c* (fig.1), under the heads

1



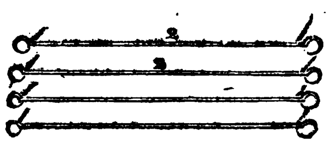
of all the casks; also a stout wooden supporter *b* inside of each, from one end to the other; which will prevent them from being crushed in by the pressure of water. Insert likewise one or two wooden supporters *d* from the uppermost or bung stave to the one opposite, to enable the cask to sustain a weight equal to that which it will buoy up in the water. An iron or tin tube *a*, one inch in diameter, is to be passed through each, from the bung-hole or uppermost stave to the one opposite—fitted close, so as to prevent the

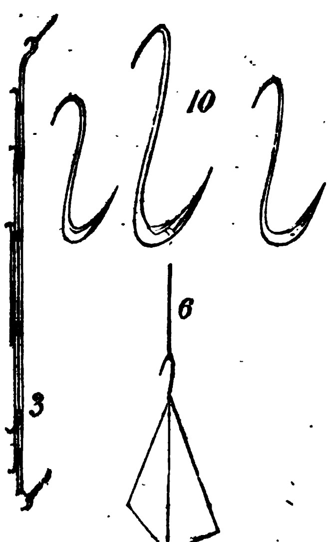
* Though the timber of some ships is, of course, more buoyant than that of others, from various circumstances, yet this calculation will be sufficiently exact to show the principle of the plan.

admission of water; the use of which will appear hereafter.

I come now to describe the machinery by which the casks are to be hauled down and attached to the ship to be raised.

An iron frame to go under her bottom is to be constructed, consisting of four, six, or eight bars, or more, if necessary (as in figs. 2 and 3). The diameter of each of





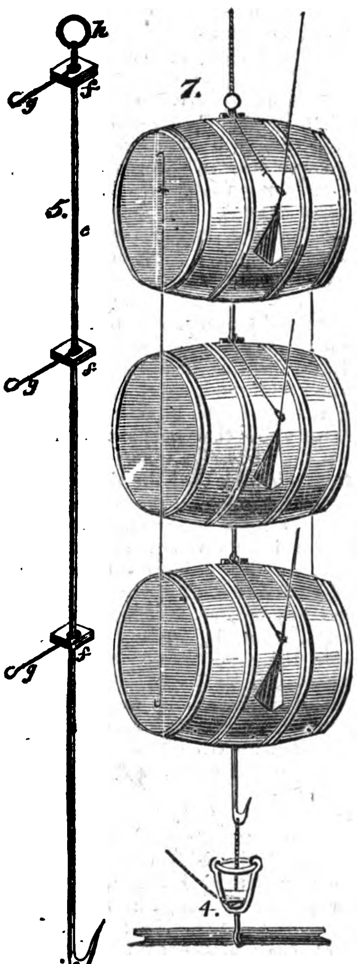
the long bars which go fore and aft the ship to be about three inches and a quarter,* and the length to be the same as the ship, from the forefoot to the after part of the rudder, with an eye at each end. Two bars somewhat shorter (as represented in fig. 3), are to be constructed, to go athwartships under the head and stern; each of which is to consist of as many bars, bound together with iron, as it is calculated will be necessary to form the frame at each side. For example, suppose the frame to consist of eight fore and aft, or side bars, that is, four at a side,—in that case, each of those athwartships must consist of at least four, of different lengths, as represented in the figure,—to be three inches and a quarter in diameter, the same size as those fore and aft, the ends of each to turn down so as to form a hook: the four are then to be bound or lashed together into one, so as to form a bar of the same strength as the whole of the others, with four hooks at a side, pointing inwards, of a proper size to admit of the long bars going easily over them, and at a distance from each other of not less than the breadth of a leager; and the probable quantity of iron necessary for this purpose will be about ten or twelve tons.

It is obvious that the size of the bars described will be sufficiently strong to raise the largest ship in the world. However, should any doubts on this point exist, all the bars, both fore and aft and athwartships, may be strengthened with the greatest ease, by lashing together double the number, or even more, if necessary, so as to make them capable of sustaining any weight whatever that may be required; and at no other additional expense than the actual value of the iron, at so much per ton.

Upon each of the long bars, a number of iron machines, fig. 4, are to be fitted, to which the casks are to be attached, and therefore fixed at a proper distance to admit of their going down clear of each other; each of the said iron machines is to consist of a strong ring at the top of two perpendicular irons of the same strength, between which, and immediately under the ring, a wooden roller is to be fixed. The necessary number of casks being secured and fitted in the manner already pointed out, it will be necessary to consider the probable number on top of each other, which will

* A bar of iron three inches and a quarter in diameter is capable of sustaining a weight, perpendicularly suspended, of about six hundred and sixty tons, as ascertained by experiment.

reach from the frame under her bottom to the gunwhale at the side which is uppermost, which number may be hauled down at a time in a bunch, attached to each other in the following manner :—



A machine, (as represented in fig. 5), is to be constructed, consisting of an iron bar *e*,* 7-8ths of an inch in diameter, a sufficient length to pass through the tubes of all the casks,† in a bunch, to be hauled down at a time; a hook *i* to be at the lower part, a sufficient size to pass through the ring in fig. 4, on the long bars, the pointed part of which is to be divided by a joint, and fitted with a spring. An iron nut *f*, to screw over each cask on the bar, will also be required, to prevent them from pressing against each other; each nut to have a rivet over it, through the bar, as an additional security. When all the casks are on the bar, an eye *h* at top is to be screwed on. A small bar *g*, with an eye at the end, is to be fixed over the nut, above each cask, to which an iron weight (fig. 6) is to be hooked, for the purpose of carrying them down. All the casks on the bar are then to be bound together, by either a line, or strong piece of wire at the heads (fig. 7), to keep them steady in their descent.

A long deal spar (fig. 8) will be

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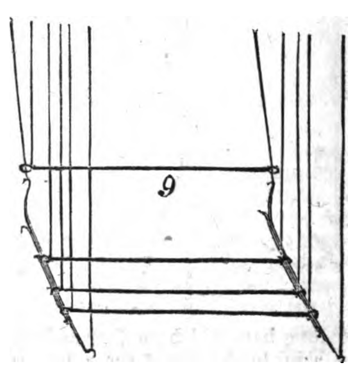


necessary to float over each bar of which the frame consists, with a number of iron pins to belay the ropes to, by which the casks are hauled down. Each spar must, therefore, have the same number as there are to be bunches of casks on a bar; that is, a separate pin for

* A bar of iron, 7-8ths of an inch diameter, is capable of sustaining a weight, perpendicularly suspended, of about thirty tons.

† Hence the necessity of the tube previously alluded to.

each rope, which will effectually prevent them from getting foul, or any confusion amongst them.

Every thing being now prepared, the bars of which the frame is to consist are to be buoyed up with empty casks, and towed out directly over the ship to be raised. The two short or athwartship bars are to have the ends of two ropes, which I shall denominate brace-lines, made fast near the centre, between the innermost hooks; they are then to be stopped out, one at each end of the same bars, with a single stop that will easily break. The said bars are likewise to have a lowering rope attached to the end of each, by which they are then to be lowered, one a-head and the other a-stern of the ship, under which they are to be hauled close by means of the same ropes, which are then to be belayed to the pins in the respective spars belonging to each.

The ropes, which I shall denominate hauling lines, by which the casks are to be hauled down, are then to be rove through all the rings, and under the rollers, upon two of the long, or fore and aft bars, making fast the ends to the respective pin belonging to each on the spars. The greatest care must be taken, in the first instance, to keep them clear; after which, with common attention, they cannot get foul, each rope having its separate belaying pin.

Having proceeded thus far, the next thing to be done is to attach the two long bars to the short ones already lowered under the head and stern, in the following manner:—

Bring the brace-lines and lowering ropes at the ends of each of the athwartship bars together, and reeve them through the eyes of the long bars; they are then to be lowered, one at each side of the ship, likewise by a lowering rope at each end, when they cannot fail to fall over the ends of those athwartships (fig. 9) the ropes which are rove through the eyes guiding them towards their destination. They are then to be hauled as close as possible under the ship's bottom, by the lowering ropes of the long bars, and bracelines before described, the stops of which will easily break; the hooks on the short bars will catch in the eyes, and prevent the possibility of their flying back. The hauling lines for the casks being already rove, they are then to be taken off the spars one at a time, one end of which is to be attached to the hook in fig. 5, the other to lead into a lighter.

The casks, which are to be hauled down in bunches, must have a slip rope for a guy to each bunch (see fig. front page), to prevent it from turning round in its descent. An iron weight of 27cwt. must then be hooked to each cask in the bunch, for the purpose of carrying it down, that being about the weight of iron a leager will buoy up; consequently little more pull will be necessary to get them down, then merely hauling through the slack of the hauling line of each bunch, to guide them to their places, and the moment the hook passes through the ring, it must catch of itself, in consequnece of the spring thereon.* The rope at the top of each bunch is then to be knotted across the wreck to the one opposite, a precaution which will be necessary with all the casks throughout the progress of the undertaking, in order to prevent her, in her ascent, which will be sudden, from tilting over, and falling off the machinery, in consequence of the side which happened to be most buoyant rising more rapidly than the other: but should the masts be above water, as was the case with the Royal

* When a bunch of casks is hauled down as low as it will go, and it is found that it does not immediately hook, the cause will be evident, either from the fore and aft bars of the frame being so far under the bottom, as not to leave sufficient space for the casks to go between the ground and ship's bilge, a gun, the channels, or something else projecting out from the wreck, thereby obstructing it from being hauled to its destination, an S hook, as long or short as necessary, added to the hook at the lower part of fig. 5, will remedy this inconvenience.

George, it would be more desirable to make the ropes fast thereto. As soon as each bunch of casks is hooked, the weights are then to be detached therefrom, and hauled up by the ropes belonging to each, leading to the surface (fig. front page), when every cask will then act upon the wreck with its full power of buoyancy.

When there are as many casks on the two first bars as can be hauled down, and it is found the ship does not rise, let two more of the fore and aft bars be sent down, one at each side, in the same manner as the former; haul as many more bunches of casks down upon them as they will contain, in the manner already described; if that will not do, send another bar down at each side, and so on, till you have as many fore and aft bars down as there are hooks on those athwart-ships, under the head and stern, and that the length of them will admit of; by which means, an immense number of casks, even to the amount of some thousands, if necessary, may be attached to a sunken ship without any very great difficulty. It follows, of course, that when a sufficient number are down she must rise, whatever her size or weight may be, and when at the surface, more casks may be added, in case of any accident happening to those already attached to her.

A, in the drawing on the front page, represents a ship at the bottom of the sea, with the machinery attached for raising her; B, the spars for belaying the ropes to; C, the hauling down ropes; D, lighters; E, bunch of casks; F, stop rope for a guy; G, the hauling up ropes.

Deal spars, substituted for casks, will answer the purpose nearly as well. As many as will be practicable to haul down at a time, may be lashed together, and sent down upon the same kind of frame, and, with the exception of the bar which passes through each bunch of casks, by means of the same machinery, and in precisely the same manner. Having ascertained by experiment, that one cubic foot of well seasoned deal, will, upon an average, buoy up thirty-six pounds of iron, it therefore follows that 35,112 cubic feet of the same timber, will be the quantity necessary to raise 564 tons, 5 cwt. 80 lbs., and, consequently, a first rate.

Thus may a line-of-battle ship, of the largest class, be raised by about forty or fifty men, with two small lighters and a few boats; and though (to the best of my knowledge) the raising of the Royal George has been for a number of years considered an impossibility, yet, I think, on inspection of this plan, had it been invented and adopted in the first instance, the practicability of the undertaking will not only be seen at once, but likewise the ease and trifling expense with which it might have been accomplished. Neither have I the slightest doubt, but (with one proviso) that if the Royal George is not sunk too deep in the mud as to admit of the machinery being got under her bilge, she might even now be raised without any extraordinary difficulty. A considerable number of casks, it is true, would be required, and it was my original intention to have formed an estimate of the number necessary to raise her in her present condition; but as it was not in my power, in a recent visit to Portsmouth, to procure a diving-bell to go down and examine her state, and quantity of mud in her, I found it impossible to make the necessary calculation.

JOHN PHEPOE,
Lieutenant R. N.

FIRE-ESCAPES.

We now proceed, as promised in our last Number, to give brief abstracts of the remaining communications which we have received on the subject of extricating persons from houses on fire; not doubting but the writers will agree with us, that it is better to give an early place to their contents in this shape, than to delay their appearance for anything in the nature of mere form-sake.

Mr. Saul, to whom our pages have been so often indebted for valuable

plans and suggestions, proposes that to the joists in the flooring of the top room of every house, immediately under the window, there should be firmly attached a light wire chain ladder, which might be coiled up, and covered over by a lifting door, when not in use, and instantly resorted to in cases of danger. The same objection may be stated to this plan, which has been advanced against so many others; namely, that it requires every householder to provide himself with such a fire-escape, while there is no reasonable probability that one in a hundred would ever be prevailed upon to do so. Mr. Saul, however, suggests, that were such an Association as that proposed by Mr. Hudson established, the fire-escape men to be employed by it should, each of them, be provided with a chain ladder, (which he might carry under his arm,) and a short gun, with which to send a line into any window of a house on fire, by means of which the persons in danger might afterwards draw up the ladder. Captain Manby has proposed (see "Mech. Mag." vol. iv. p. 113) to send a line on board of a stranded ship by means of a mortar; and Mr. Saul does not see why a musket might not serve a similar purpose in the case of a house on fire. A cross-bow would, we think, answer quite as well, and be attended with much less risk.

"T. D." would also have a chain ladder provided for every house, with the addition of "a flat chain, of corresponding length, which is to run over a roller fixed under the window sill, and to have a strap attached to it, for putting round the waists of women, children, or other timid persons; so that, in case of their slipping from the ladder, they would thus be prevented from falling." There can be no question, that if ladders are adopted at all, chain ladders, which will neither burn nor attract flames, must be superior to all others.

Mr. Brew proposes to extricate persons in danger from fire, by means of a small railed platform, raised and lowered at will by an apparatus which he describes. This plan is similar, *in effect*, to that of "A Member of the Richmond Mechanics' Institute," given in our last Number; but the description of apparatus proposed by Mr. B. would be extremely cumbrous and difficult to manage. We are persuaded that Mr. Brew will be of this opinion himself, on the perusal of our last Number, and shall therefore refrain (for the present, at least) from entering farther into the merits of his plan.

Mr. Wansbrough, of Fulham, writes to the following effect:—

"Some years ago I saw, exhibiting from a second floor window of a house in Picket-street, Temple-bar, a fire-escape apparatus, which, from the facility of its operation, appeared admirably adapted to the purpose intended.

"A single sheaved block was secured to the wall, beneath the window, through which was passed a rope twice the length of the elevation, covered with worsted, and having a sling of very broad web at each end. Over this arrangement was placed a tête-a-tête sofa, firmly secured to the wall by ropes, long enough to allow the seat to be placed outside, and even with the sill of the window. The whole appeared, to a common observer, but as an article of furniture, when covered. The escape was performed by getting on the seat of the sofa, which could be instantly placed outside the window, and by passing the sling under the arms, or sitting in it, sliding down with perfect safety. The ascending portion of the rope acted as a guy, and being covered, protected the hands from being injured by the rapid friction. Thus, no time was lost; and a number of sufferers might be extricated in quick succession. The projection of the sofa served to throw off the body, in its descent, from the rails of the area, or any other obstruction that might happen to be in the way.

"There was an alarum-bell attached to the apparatus, which was set off by the descent of any one; so that, even in the hurry and anxiety of the moment of *self*-preservation, the sleeping inmates might be

aroused to a sense of their danger, and be enabled to make their escape."

From the description of this apparatus, we presume it was that of Mr. Whitty, noticed by Mr. Baddeley (p. 213). An escape nearly on the same plan was exhibited a few days ago, in Regent-street, by Mr. Read, the inventor of the stomach pump, and is thus described in "The Times" newspaper:—

"Mr. Read, the patentee of the stomach pump, descended on Wednesday last from a window nearly sixty feet from the ground, by means of a simple fire-escape of his invention. The apparatus consists merely of a rope twice the length of the height of the place where it is attached. Above the window of the chamber is a ring fastened to the wall, inside the room; a bar crosses the ring perpendicularly, and around this the rope is reflected. Some strong web, which forms a seat, is attached to one end of the rope; and the other being thrown out of the window, the persons escaping from a house on fire lower themselves into the street, by allowing the rope to pass gradually through their hands, as they descend. In the same manner, children or others may be let down by any one of ordinary courage and coolness; for which purpose a bag is appended to the rope, in which they may be securely enveloped."

To all such plans, however, there is the insuperable objection before mentioned; namely, that every house must make a separate provision for the security of its own inmates.

"J. O.," in reference to this subject, closes some sensible remarks on the apathy with which the best of projects are sometimes regarded, when they happen to concern that insensate sort of personage, "Everybody," by expressing an ardent wish "that the proposal of Mr. Hudson, for establishing a Society for preventing the Loss of Lives by Fire will not be suffered to remain dormant, as it seems the only probable means of bringing into application the several useful inventions that have been and may be suggested, both in the pages of the 'Mechanics' Magazine' and elsewhere."

We agree with our correspondent, that such an Association would be of the greatest utility; and hope, ere long, to have it in our power to congratulate Mr. Hudson on the success of his humane endeavours to bring about its establishment.

[Two other communications on the subject, from "J. S. S." and Mr. Davy, have come to hand since the preceding article was in type.—EDIT.]

IMPROVED STEAM PISTONS.

Sir,—I have, within these few days, received a letter from an ingenious English mechanic, now, and for some years past, employed in Russia. I do not think that I can more completely promote his wishes (which are evidently that the merits of his proposed improvements should be freely and fairly investigated), than by transmitting his communication for insertion in the "Mechanics' Magazine."

I am, Sir,
Yours, &c.
O. C. F.

April 24, 1828.

"Sir,—Having lately seen an account of the action brought against Messrs. Hall and Son, by Mr. Barton, for an infringement of his patent for metallic pistons, and Dr. Olinthus Gregory's excellent opinion on the subject, I am induced, by your well known love of science, and the readiness you have always shown to give every assistance to the promulgation of new inventions and improvements, to submit to your better judgment a construction of pistons which I conceive to be superior to that of Mr. Barton's, and free from the objections stated by Dr. G. I am persuaded, that should it meet your approbation, it will not fail to be speedily introduced into practice.

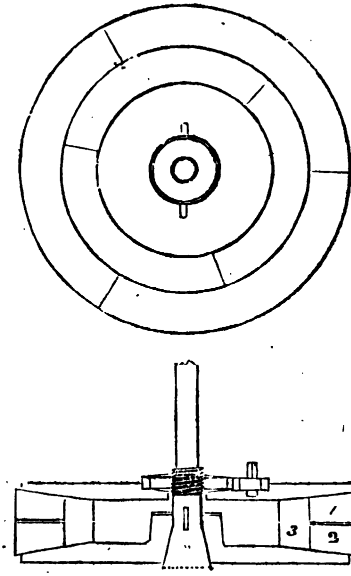
"Before proceeding to describe the invention, however, I may just mention (by way of apology for one

who is merely an operative mechanic presuming to obtrude his notions and plans on a matter of so much importance), that I worked fifteen years in most of the principal engine manufactories in London; and during the twelve years I have been here (under contract to the Russian government), have been successful in constructing many new machines, and improving others, and have had opportunities rarely enjoyed, of making models and trying experiments.

"About two years ago I made three pistons on Mr. Barton's principle, of nearly six inches in diameter. When one of them had been at work some time, I found the cylinder exactly as Dr. Gregory describes,—*worn into furrows.** The workmanship, I am sure, was not in fault, for I made the pistons myself; not daring to trust Russian workmen with the execution of a part of an engine on the accuracy of which so much depends. At first I did think that my handiwork had proved defective, and not the principle of the thing; but having afterwards 'well considered my job,' as Mr. Perkins would say, and seen the observations of Dr. Gregory in the cause before mentioned, I became convinced that the error was in Mr. Barton's mode of construction, and was accordingly led to devise the improvement I am now about to describe. *Apropos*, however, of Mr. Perkins and pistons—allow me, by the way, to mention, that having lately taken to pieces one of Mr. Perkins's pistons, I was surprised to find it, though made of four steel rings, worn in races, and not well put together, with small worm springs that had no effect on the large rings, &c.

"The sketches Nos. 1 and 2 represent a piston constructed on the plan of two inclined planes, with segments, in the common way.

1.



"In No. 1, the wheel nut brings down the cap to a sufficient tightness, ejecting the segments outwards;—as to receding, that is out of the question. A piston thus constructed takes the quality of a solid, but will require to be adjusted while hot, on account of the unequal expansion of metals. There will be no danger, however, of setting fast, as was once the case at Leeds (not at Murray and Wood's).

"The mode of construction represented in No. 2 is, you will perceive, nearly similar, except that the wheel nut is substituted with a common nut screwing down a strong cross spring acting on the cap of the piston, and allowing the segments free action. The cross spring may be made of any strength, to suit the diameter of a large cylinder, even as thick as a coach spring, and will not be so soon out of order as the ones at present in use.

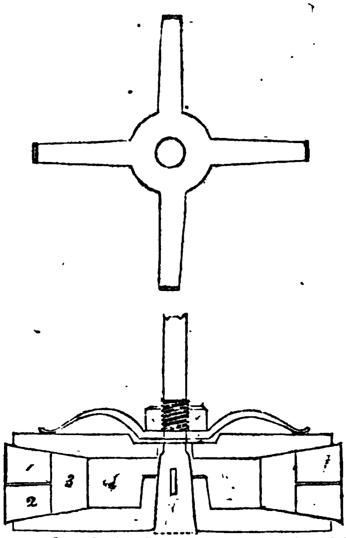
"As high-pressure engines are

---

* Dr. G.'s statement was, that "the protrusion of the angle of the wedges beyond the general surface of the portions of the ring between which these wedges are placed, soon wears the cylinder into furrows, and prevents it from being steam-tight; on this account, Barton's pistons, after a little trial, are abandoned, and others substituted for them." Better evidence of the correctness of Dr. G.'s statement could not be desired, than the voluntary testimony which we now make public.—Ed. *M. M.*

now daily coming more into request, I shall be much gratified if, through your means, this little contribution

2



towards their improvement should be found serviceable.

"I ought to add, that the difficulty which, in common with other English mechanics who are scattered over the Continent, I experience in communicating with the scientific journals at home, has been one cogent reason, among others, for my troubling you with this communication. All these journals require that letters to them should be *post paid.* Now, it is well known, that from the North of Europe letters can only be post paid as far as Hamburgh; and as the London journals will not pay the onward postage, the Dead Office becomes, of course, the grand receptacle for the favours of their foreign friends and admirers.

"I am, Sir,
"With due respect,
"Your obedient Servant,
"William Reed."

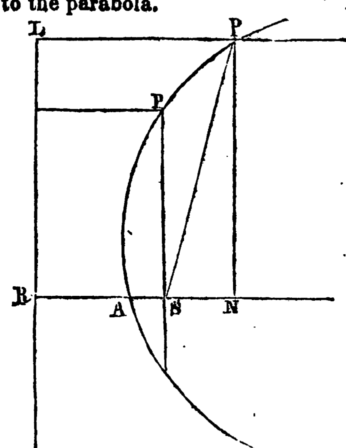
Imperial Paper Mill,
Peterhoff, near St. Petersburgh,
Feb. 1828.

[We shall be glad to hear again from Mr. Reed, either through the medium of his friend, O. C. F., or directly, as he may see best, with an account of the other new inventions to which he alludes in the beginning of his letter, and at all times, on any subject which he may consider of interest to the cultivators of science. The difficulty to which he alludes in his last paragraph will, as far as we are concerned, be obviated by his superscribing any letter to us with his name, which will, in that case, be received, and any postage willingly paid. It is only the danger of a deluge of trivial communications, not worth the heavy expense of foreign postage, which deters us from extending a similar exception to *all* our countrymen abroad.—Ed. *M. M.*]

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(*Continued from p.* 250.)

19. Let us now find the equation to the parabola.



Suppose L R to be a line whose position is given, and S a point likewise given.

Draw R S N perpendicular to L R, and let the line S P revolve about the point S, and be taken always equal to line P L, drawn perpendicular to L R, the point P traces out

a curve, A P P, which is called a parabola. The line L R is called the directrix, and the point S the focus. It is evident that the point A must bisect the line R S; for the curve is such that the perpendicular A R, from the point A, is equal to the line A S, from A to S, in the same way as L P=S P.

R S is given: let us call it $2a$, and let us measure x from R.

Now, $SP^2 = SN^2 + NP^2$, by Euclid.

$= \overline{RN - RS}^2 + NP^2$;

or $SP^2 = \overline{x - 2a}^2 + y^2$

But $SP^2 = RN^2 = x^2$

$\therefore x^2 = \overline{x - 2a}^2 + y^2$, or $x^2 = x^2 - 4ax + 4a^2 + y^2$

$\therefore y^2 = 4ax - 4a^2 = 4a.\overline{a - x}$.

If, as is most usual, we measure x from A, instead of R, the equation becomes

$$y^2 = 4ax.$$

Let us call these equations A and B.

$$y^2 = 4ax - 4a^2 \text{ (A)}$$
$$y^2 = 4ax \text{ (B).}$$

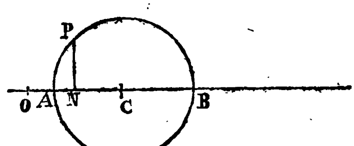
20. From these equations to the circle and parabola, it is easy to describe them.

Taking the first equation to the circle,

$$y^2 = 2ax - x^2 + (r^2 - a^2)$$

we have $y = \pm\sqrt{2ax - x^2 + r^2 - a^2}$.

Let O C be an indefinite straight line, and O any point in it.



Take O C $= a$; then C is the centre of the circle; and from C, in the direction C O, take C A$=r$. Then O A$=\overline{a-r}$, and A is the point where the curve begins.

For if x be less than $\overline{a-r}$, the quantity under the root will, on examination, prove negative, and y will, consequently, be impossible; which shows that the curve has then no existence. When the generating point arrives at A, or when $x = \overline{a-r}$, the quantity under the root becomes altogether evanescent; but as we advance from that point, the expression $\pm\sqrt{2ax - x^2 + r^2 - a^2}$ gradually increases, till $x = a$, when its value is the greatest, and the ordinate, y, becomes equal to the radius; after this, it diminishes as it before increased; and when $x = \overline{a+r}$, or the generating point arrives at B, the ordinate again becomes evanescent; after which the expression, $\pm\sqrt{2ax - x^2 + r^2 - a^2}$, becomes impossible, as before; and the curve, which is a semicircle, terminates at that point.

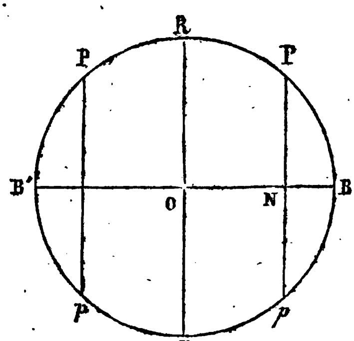
Since $y = \pm\sqrt{2ax - x^2 + r^2 - a^2}$, and we have considered only $+\sqrt{2ax - x^2 + r^2 - a^2}$, we must now remark that $-\sqrt{2ax - x^2 + r^2 - a^2}$ will give a branch exactly similar under the axis, instead of above it, which will complete the circle.

In this case, if x be negative, y is impossible; which shows that the curve has no negative branch.

21. To illustrate the negative branch of a curve, or the branch on the negative side of O, we will describe the circle from Equation 3.

$$y^2 = r^2 - x^2, \text{ or } y = \pm\sqrt{r^2 - x^2}.$$

Let B O B be the line of the axis, and O the origin of the curve which is now the centre.



When $x = o$, $y = r$ (taking the positive value of $\sqrt{r^2 - x^2}$), or at the origin the ordinate is equal to the radius; as x increases $\sqrt{r^2 - x^2}$, or y diminishes, and where $x = r$, $y = o$, or the curve cuts the axis at B.

If x be greater than r, then $\sqrt{r^2-x^2}$ is impossible; for r^2-x^2 will be negative.

Hence the curve which is a quadrant has no existence after the point B.

By using the negative value of $\sqrt{r^2-x^2}$, we shall have a similar curve beneath the axis; and thus a semicircle R P B p r is formed.

Now, taking the negative value of x, or measuring in the direction O B, the quantity $\sqrt{r^2-x^2}$ still remains possible, and of the same value as before, at the origin $y=r$; and as x becomes more nearly equal to r, the ordinate diminishes, and when $x=r$, it vanishes; so that we have a quadrant R P B for the positive value of $\sqrt{a^2-x^2}$, when it is negative. We shall have a similar quadrant, B p r, for the negative value of $\sqrt{a^2-x^2}$, which will complete the circle.

(To be continued.)

TUNNELLING.

Sir,—Mr. Deakin seems to lay great stress upon his proposed road being lowest under the channel of the river, and either forgets or never knew that Mr. Brunel's road *is formed in the same way*. The two plans are, therefore, in this respect, *exactly alike*. Mr. D. says, that in the middle of the river Mr. B. had *no earth* over his tunnel. Those who are correctly informed of the matter know this to be a very unfair statement. In No. 244, page 206, Mr. D. asks, first, "when and where," &c. I certainly never saw a tunnel made *exactly* like the one he proposes, nor do I ever expect to see such a one. I said there was nothing new in his plan. I meant there was nothing new *that was worthy of notice*, with one trifling exception, which I named. Going deep has been proposed by scores. The iron boxes, and the road being lowest under the middle of the river, were adopted by Mr. Brunel. Every one knows that the pressure upon a broad opening is greater than on a narrow one; and, therefore, that two narrow openings would be easier made than one broad one. And now, what is there left? *Why, two shafts, eight feet diameter, and one hundred feet deep, and an eight feet drift* (in the case of the Thames Tunnel), *about five hundred feet long, which is to have air-tight planking, raised three feet above the bottom*. If this is what Mr. D. means to claim as *new*, he is quite welcome to it. It puts me in mind of the farmer, who first cut a hole in his barn door to admit his cat, and then a smaller one for the convenience of her kittens.

But Mr. D. seems out of temper, which I am sorry for, as I had no wish to offend him. He seems to insinuate, that I ought to have been drowned in the Thames Tunnel for presuming not to admire his plan, which I think rather severe. I must, however, inform him, for his satisfaction, that I have no *experience* in *mining*, and should most likely use a pickaxe or shovel very awkwardly. He will, perhaps, allow me to say, there is a wide difference between *calling* a man unwise, and *making him appear so*; and that I think the cool, candid style of his letter, in No. 242, much more creditable than the testy manner in which he has thought proper to make his last communication.

I am, Sir,
Yours, &c.
S. Y.
A Young Engineer.

April 29, 1828.

IMPROVED WINDOW SHUTTERS.

Sir,—I have constructed external shutters, with which windows can be covered (so as to protect them from a hail or mob storm), by a person standing inside, in half a second of time. In short, they are as easily shut and opened, as a common parlour bell is wrung; while either opening or closing, or open or closed, they are not in the smallest danger of being affected by the strongest wind. In houses newly constructed they may be made to be seen or not externally, as is desired; or, if necessary, they may be made

bullet proof, as it is a matter of little consequence which they weigh, half a hundred weight or half a ton, a child of three years old can open and close them; while the mode of moving them need be no internal disfiguring to the most elegant room. To a window at any height, they can be fastened on the inside, without opening the sashes, more securely than any other shutter that I know of in present use: at the same time, they will protect the sashes from fire, when adjacent houses are burning. I have had a shutter on this plan, the first attempt, set up already on the window of the Ennis Savings' Bank, which, though seven feet high, and five wide, and weighing over ten stone, is as easily opened and closed by a person standing inside, and also fastened and unfastened, as could be wished. And what adds to the perfection of my plan, is, that when once seen, Columbus's mode of putting the egg standing on the end of it, is scarcely more simple, or provokingly obvious.

I am, Sir,

Yours, &c.

C. A. BREW

Ennis, April 5, 1828.

[A mob and bullet proof window is unfortunately of more utility in the sister island than in England or Scotland; but though we have no Rockites, we have midnight depredators in abundance, and shall therefore be glad to receive from our correspondent a more particular description of the means of security he has devised.—EDIT.]

NEW PUBLICATIONS

Connected with the Arts and Sciences.

A Dictionary of Chemistry, and of Mineralogy as connected with it; in which is attempted a Complete List of the Names of Substances, according to the present as well as former Systems; with an Introduction, pointing out the order in which the chief parts of the Work may be perused, so as to constitute a Regular Course of Chemistry; and a Vocabulary in which the Apparatus and Processes made use of are briefly described; Copious Notes, &c. &c. By WILLIAM CAMPBELL OTTLEY. Pp. 392. 8vo.

Two very respectable Dictionaries of Chemistry, the one by Messrs. Nicolson and Ure, the other by the Messrs. Aikins, are already known to the public; but as both are rather bulky productions, both too costly for the humbler sort of inquirers, and neither so free as could be wished of exploded doctrines and obsolete phraseology, we are willing to allow that there was ample room for a third, which should be cheaper, better digested, and more applicable to the existing state of science than either.

We cannot say, however, that Mr. Ottley's work is exactly the sort of substitute which was wanted. It is a widely printed twelve-shillings volume, containing not a fourth of the matter of either of its predecessors, and much dearer at 12*s*. than the others are at 1*l*. 1*s*. and 4*l*. 10*s*. Nor is the lesser portion of matter, of which it consists, so much distinguished for selectness and condensation, as for mere verbal parade, frequent error, and general superficiality.

We have such simple words as *absorb, abstract, clarify, coagulate, combine, condense, corrode, dissolve, evaporate, inflame, refine, roast*, &c., ostentatiously made the subjects of superfluous definitions; while others, which unlearned readers do require to have explained to them, such as *pseudomorphous, pulverulent, lamellar, salifiable*, &c. are used without any explanation whatever.

One division of words is given under the head of a "Vocabulary," and another under that of "Dictionary;" but for no sensible reason that we can discover. For example; the words *atmosphere, fermentation*, and *specific gravity*, are classed in the one division, while their nearest of kin, *light, heat*, and *bodies* (simple and compound), are assigned to the other. If you wish to learn why a substance is called *caustic*, you must consult the "Vocabulary;" why *antiseptic*, you must turn to the "Dictionary." There are other things again, such as *precipitates* and *stills* (for the latter, see *Water, Distilled*), which come in for a word or two in *both* departments. No real line of distinction, in fact, exists, and, accordingly, none has been observed. We have the affectation of method, without the thing itself.

Mr. Ottley says, in his Introduction, that "Sir H. Davy's theories have

been *strictly adhered to*" (the italics are his own); but so far is this from being the case, that every page is, more or less, tinged with assumptions which are in direct opposition to one of the most important and most extensively applicable theories which Sir Humphrey Davy ever promulgated.

Heat, according to Sir H. Davy, is the result of a vibratory motion of the particles of bodies, and varies in degree with the velocities of the vibrations; while, by Mr. Ottley, heat, or, what is the same thing, "caloric, the matter of heat," is uniformly treated as a specific substance—imponderable, it is true, yet penetrating and dilating all bodies, by insinuating itself between their particles. Hence we have oxygen gas defined by Mr. Ottley to be "a compound of the simple substance, called oxygen with caloric;" while a believer in "Sir H. Davy's theories" would have refrained from assuming the separate existence of the caloric, and been content to represent oxygen and oxygen gas as being precisely the same thing, under two states of existence, the one combined, the other free. All the other gases are defined by Mr. Ottley in the same way; wherever, in short, heat or caloric is concerned, he distinctly takes its MATERIALITY for granted. We do not mean to say that Sir H. Davy's theory is the correct one—at all events, we have no intention of entering into an argument on the subject at present. We desire only to point out how widely Mr. O., who professes to have taken Sir Humphrey for his guide, happens to differ from him. We have no wish to impute to Mr. O. a deliberate design of courting popularity by fighting under false colours; but if, to spare his integrity, we suppose that he acted under a mistake as to Sir H. Davy's notions on this leading topic, what must we think of his knowledge of chemical history? What does he say himself of persons by whom these theories are "as yet but imperfectly understood?" Precisely what we fear others will say of him, that they are "persons having but a *slight knowledge* of chemistry," (*Introd.* page 11), and of course extremely unfit to give what Mr. O. nevertheless professes to give, "a comparative view of the old and new theories, showing the reasons for changes made in the nomenclature," &c.

In treating of *light*, Mr. O. is not more consistent than with respect to *heat*. He states, that "several theories have been advanced by philosophers as to what light is;" that "some have supposed it to be a real substance in very minute particles," while "others maintain that it is merely an effect which certain bodies have upon the organs of sight;" but that neither of these theories has been "satisfactorily proved."—(*Art. Light.*) But though he here distinctly admits that there is *no satisfactory proof* of the materiality of light, we find him elsewhere defining hydrogen to be "a simple body, which, by its combination with a large quantity of caloric and *a small quantity of light*, forms hydrogen gas" !! Nothing can have a worse effect on the young student than definitions made up of such loose and fanciful assumptions as this.

The best feature of Mr. Ottley's book is the care he takes to give the different names, popular and scientific, which have been given to the same substances. Thus a beginner may, by an alphabetical reference to either set of terms, learn that *Nitric Acid* is but another phrase for *Aquafortis*.

Sulphuric Acid, for *Oil of Vitriol*.
Ammonia, for *Spirits of Hartshorn*.
Hydrochlorate of Ammonia, for *Sal Ammoniac*.
Sesquecarbonate of Ammonia, for *Sal Volatile*.
Chlorine, for *Aqua Regia*.
Cyanide of Iron, for *Prussian Blue*.
Subacetate of Copper, for *Common Verdigris*.
Sulphate of Copper, for *Blue Vitriol*.
Supercarbonate of Iron, for *Plumbago*.
Acetate of Lead, for *Sugar of Lead*.
Sulphate of Lime, for *Gypsum*.
Sulphate of Magnesia, for *Epsom Salts*.
Bitartrate of Potass, for *Cream of Tartar*.
Carbonate of Potass, for *Pearlash*.
Superoxalate of Potass, for *Salt of Sorrel*.
Subborate of Soda, for *Borax*.
Nitrate of Potass, for *Sal Prunelle*.
Nitrate of Silver, for *Lunar Caustic*, &c.

But though such explanations are undoubtedly of great use, and more attended to, perhaps, in this work than any other, it would be too much, in the absence of more substantial merits, to recommend it on the strength of these alone as a good text book for chemical students.

Mr. Ottley says that he has inserted in his work "*everything* which he believes essential to a knowledge of the principles of chemistry; so that by a careful perusal of the different parts of the work" (in an order which he afterwards points out), "a person hitherto unacquainted with the subject may be enabled to instruct himself concerning

it."—(*Introduction*, p. iii.) And it was on account, chiefly, of the promise here held forth, and for the sake of the many individuals among our readers who are obliged to have recourse to this sort of self-instruction, that we were induced to enter upon a scrutiny of its merits. We were sure that if a book could be produced, which would thus serve, at one and the same time, the purpose of a methodical treatise on chemistry, and a dictionary of reference, it would, even at the price charged for the one before us, be a valuable present to a numerous class of inquirers. Such is, by no means, however, the character we should think of giving Mr. Ottley's book. Any person who, being "hitherto unacquainted" with chemistry, should expect to "instruct himself concerning it," by means of this Dictionary, would find himself, in the end, miserably deficient in his knowledge of all that concerns it, both theoretical and practical, historical and speculative. To enumerate its sins of omission would be superfluous: it is *altogether* so superficial, that we do not think there is one article of which we could safely say that it contains the information necessary for a right understanding of the subject in hand.

Originality is not, of course, a quality to be expected in a work of this kind, nor at all essential to its excellence; but one thing of this description we do meet with in Mr. O.'s book, which is worth transcribing, and is very creditable to his judgment and ingenuity.

Our readers are aware of the danger which for a long time attended all experiments with the oxyhydrogen blowpipe, in consequence of the tendency of the flame to recede into the gas-holder, and of the different expedients which have been proposed to guard against it. Among these, by far the best, in our opinion, was that proposed by an esteemed correspondent of our own—Mr. Weekes, of Sandwich—who suggested the interposition of a body of sponge between the gasometer and the blow-pipe.

The following plan of Mr. Ottley's proceeds on the same principle, and appears, from his account, to be nearly as efficient:—

"Being lately engaged in some experiments in which iron filings were used, and observing that air could be easily made to pass through them, it suggested itself to me, that if the mixed gases were made to pass through a brass cylinder containing metallic filings, all possibility of an explosion would be done away with. I consequently made the experiment, and found, that from the great conducting power of the filings for caloric (*matter of heat*), and the density with which they lie together, it was impossible to make the flame recede into the gas-vessel, even when the whole of the pressure was removed; for it is immediately extinguished upon coming to the cylinder containing the filings. A blow-pipe made upon this plan is very simple, and produces a most astonishing heat; as we are enabled, by its safety, to have the jet and flame much larger than those formerly used."

LONDON MECHANICS' INSTITUTION.

NO. XV.

"Fideliter."

LECTURES.

Wednesday, April 2.—Mr. Brown, in continuation—History.

Wednesday, 9.—Mr. Brown concluded his Course.

Friday, 11.—Dr. Birkbeck, on some peculiarities in Steam Valves.

Wednesday, 16.—Mr. Christie, a Member, commenced a Course on the Decorative Branches of Civil Architecture.

Friday, 18.—Dr. Birkbeck, on the Construction of Chimneys.

Wednesday, 23.—Mr. Christie.

Friday, 25.—Mr. Chapman, on Imagination.

The Fourth Anniversary of the Institution is to be celebrated by a Public Dinner, on the 6th of June, at the Freemasons' Tavern, when the Prizes presented by Dr. Fellowes will be given to the successful Candidates. His Royal Highness the Duke of Sussex will, if his health permit, take the Chair. Among other distinguished individuals who have accepted the office of Stewards, are,—The Duke of Bedford; Sir Francis Burdett; Sir Benj. Hobhouse; Right Hon. J. Abercromby; Henry Brougham, Esq.; J. C. Hobhouse, Esq.; Aldermen Wood and Venables; Dr. Lushington; J. Smith, Esq. M. P.; J. W. Smith, Esq. M. P.; M. T. Smith, Esq. M. P.; H. Warburton, Esq. M. P.; &c.

MISCELLANEOUS NOTICES.

Rumford Premium.—In the year 1796, Count Rumford, then residing in London, presented to the American Academy of Arts and Sciences five thousand dollars in a three per cent. stock,

for the purpose of establishing a biennial premium, to be awarded to the author of the most important discovery, or most useful improvement on heat or light, which should be made in any part of America. Upwards of thirty years have elapsed, yet the prize has never been awarded to any one; and the fund, at the present time, amounts to more than fourteen thousand dollars, yielding, every two years, above two thousand dollars of interest. The next meeting of the American Academy, for the purpose of deciding on any claims which may be offered for this premium, is to be held on the 25th of the present month of May.

Anemoscope—"for ascertaining the course of the air when there is not any perceptible wind blowing." The following account of an instrument for this purpose, invented by Dr. B. M. Forster, is given in the "London Journal of Arts and Sciences," for this month. The instrument consists of an octangular tin box, with a circular opening in each of the sides; within the box, pieces of blotting paper are fastened which cover the openings. On the top or lid of the box, is a tin tube or socket, in which is a cork with a ring. The ring is to suspend the apparatus from a tree in the air. If desirable, the box may be reversed, and elevated on a pole, the upper end of which is to fit into the tin tube. The method of using this instrument is to equally wet all the portions of blotting paper which appear through the holes, and then elevate it; and after it has been exposed a short time to the air, it is to be noticed which portion of blotting paper has dried most. "This instrument," says Dr. F., "is founded on the principle by which I have understood sailors ascertain the course of the air in a calm, which is, by wetting a finger, and holding it up in the air, then, by feeling which part becomes (by evaporation) cool, they judge from whence the current of air blows." A more frequent method with sailors, than that mentioned by Dr. Forster, of finding out how the current of air blows, in what is called a dead calm, is to throw a piece of live coal into the sea and observe how the smoke which it produces inclines, (for incline one way or other it will); and, on the authority of this practice, we may venture to recommend a bason of water and a hot cinder, as furnishing a much simpler means of attaining the end proposed, than the instrument here described.

Burmese Petroleum Wells.—Some of these are from 37 to 53 fathoms in depth, and are said to yield, at an average, daily, from 130 to 185 gallons of the earth oil. The wells are scattered over an area of about sixteen square miles. They are private property, the owners paying a tax of five per cent. of the produce to the State. This commodity is almost universally used by the Burmans as lamp oil. Its price on the spot does not, on an average, exceed from 5*d.* to 7½*d* per cwt. —*Crawford's Mission to Ava.*

Substitute for Canal Locks.—We understand that an ingenious mechanic in this town, has taken out a patent for an invention to abolish locks on canals, by means of which, vessels may be raised from one level to another, 30, 40, or 50 yards, if necessary. The machinery by which this is to be accomplished, is extremely simple, and, so far as regards the mode of operation, efficacious.—*Sheffield Iris.*

Balloons.—Mr. Braun, the professor of the German language in the Polytechnic School at Paris, has addressed a letter to the French Government, accompanied with a plan of an aerostatic machine, capable of receiving any wished-for direction. The letter and plan have been referred to the Academy of Sciences; and the Academy has appointed a commission to inquire into the merit of the invention.

NEW PATENTS.

Jane Bentley Lowrey, of Exeter, Straw Hat Manufacturer, for certain improvements in the manufactory of hats and bonnets.—25 March—6 months.

Ferdinand de Fouiville, of Piccadilly, merchant, for certain improvements in filtering apparatus. —26 March—6 months.

MINOR CORRESPONDENCE.

Mr. Brew adds his testimony to that of K. B. G. (p. 365, vol. viii.) as to the effect of skim milk in making writings or drawings, made with black lead, indelible. He merely washes the black lead impression over with a feather dipped in the milk. A specimen which he has sent us resists even the application of India rubber.

C. A. B. is right in supposing that no person can take a patent out for any invention or improvement which has previously been described in this or any other publication. Nor is there any exception, even in favour of the inventor himself. The *consideration* for which the exclusive right of manufacturing any newly invented article, for a term of years, is conferred, is expressly, that the inventor has it in his power to make the mode of constructing it known to the public, or not, as he pleases; and that it is worth while to grant the temporary monopoly, for the sake of the secret divulged. After a man has once told all he knows, he can, of course, have no longer the necessary consideration to offer.

"A Mechanic," of Richmond, desirous of entering on the pursuit of Geology, wishes to know "the best work" on the subject.—We know of none better than the "*Outlines of the Geology of England and Wales,*" by Messrs. Conybeare and Phillips. He will learn from that what other works he may consult with profit.

Circulating Decimals.—Sir,—I am sorry to observe that so learned and acute a person as Mr. Utting, should write as angrily as others less highly gifted, when his mathematical erudition is called in question. How lamentable that the passions should be suffered to intrude in matters with which they have so little to do, as those of science! The errors which Mr. U. points out in Dr. Gregory's excellent system of "Mathematics for Practical Men," do not warrant the tone of triumph in which they are proclaimed. Most of them are of no practical consequence; while the Tables to which Dr. G. alluded as being erroneous, were (as Mr. U. is no doubt aware) almost uniformly wrong in the *third* place of decimals. I am, &c. T.

Islington, May 9, 1828.

INTERIM NOTICES.

An Old Friend at Lambeth, on the New London Bridge, in our next.

Communications received from Mr. Utting—W. N. C——d—F.—E. Y. R.—Mr. Saddington—Mr. Dubois—J. S. L.—Mr. Jopling—K. J.—Abraham Orchard—G. J. G.—H. H.—One of our "Oldest Readers."

We regret that, owing to an oversight, part of our last week's impression was printed on an inferior paper, not intended for this work.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster Row, London.

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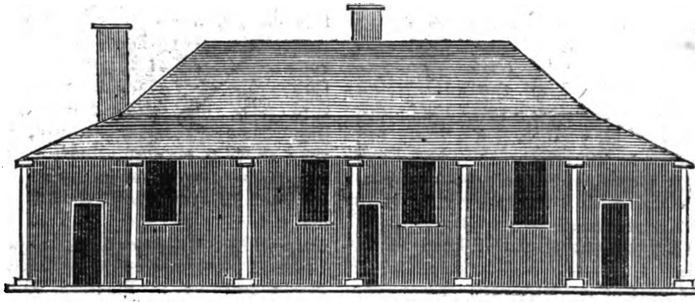
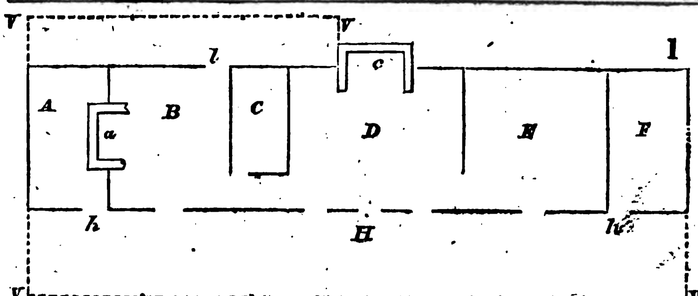
Mechanics' Magazine,

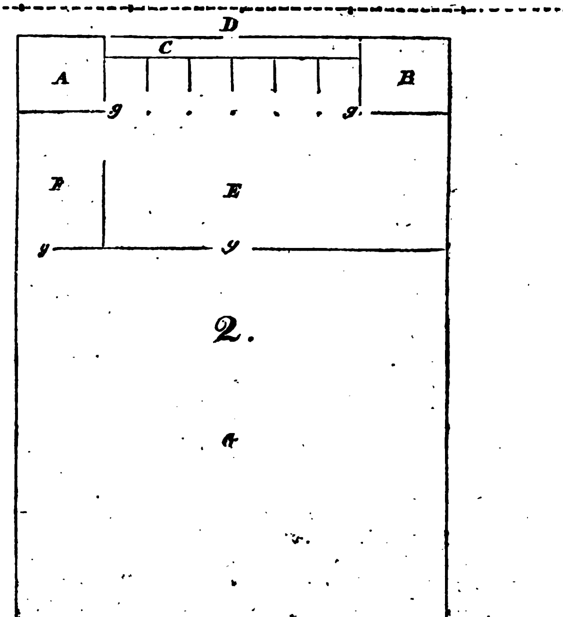
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 249.] SATURDAY, MAY 24, 1828. [Price 3d.

PLAN OF A FARMING ESTABLISHMENT FOR EMIGRANTS.







PLAN OF A FARMING ESTABLISHMENT FOR EMIGRANTS.

Sir,—A number of individuals in this neighbourhood (among whom are some respectable parishioners of my own) having resolved on trying to better their fortunes by emigration, they have been wisely collecting beforehand all the information they can obtain respecting the modes of farming, enclosing, &c. most approved at the present day, and have done me the honour of now and then advising with me as to the sufficiency of the preparations they have made. In all but one respect I have found them singularly well provided with the sort of knowledge necessary for persons embarking in such speculations; but the exception, it must be confessed, is a material one:—*they have no well defined plan of house-building adapted to the circumstances in which they they are likely to be placed.* They say, and, I believe, with truth, that though they have, in their collection of books (no contemptible one, by the bye, and including, you will be pleased to learn, more than one set of your own most valuable Miscellany), several of the best works on architecture, yet that in none of them has the construction of small farm-houses, such as first settlers are likely to require, received more than a very superficial share of attention. I had it not in my power, at first, to help them to the information of which they stood in need on this subject; but happening to mention the circumstance to my friend, Mr. ——, the Collector of a neighbouring port, he immediately put into my hands a volume, published some years ago, entitled, "An Account of the State of Agriculture, &c. of New South Wales, by James Atkinson, Esq., formerly Principal Clerk in the Office of the Colonial Secretary at Sydney;" in which I was delighted to find precisely those instructions of which my emigrating neighbours were in want. But how was one book (even if my worthy friend, the Collector, had chosen to part with it) to serve two or three hundred persons? The thought occurred to me, that were I to copy out the plans alluded to, and transmit them to the Editor of the "Mechanics' Magazine," he might probably have the kindness to allow them a place in his pages, and, by this means, not only enable every one of the party here, to obtain a copy for himself at the small cost of threepence, but place them, at the same easy rate, within the reach of hundreds and thousands more, who may be in a similar situation, and to whom they must prove equally useful. In this hope, Sir, I now accordingly forward them to you, and should imagine that, even to those of your readers who have no direct interest in matters of this sort, it will not be displeasing to see a page or two devoted to the generous purpose of enabling their expatriating, and, in all (perhaps) that regards the feelings of the heart, *unfortunate* countrymen, the better to encounter the many inconveniences and hardships attendant on every attempt of persons to establish for themselves a new home in foreign lands. Wishing you every success in your laudable efforts for the diffusion of knowledge,

I remain, Sir,
Yours, &c.
A COUNTRY CLERGYMAN.

Fifeshire, March 28.

We have much pleasure in complying with the request of our benevolent correspondent, by giving insertion to the plans and description which he has sent us. We may remark, at the same time, that the plan of the house, though in general good, appears defective, in as far as regards the offices which should be attached to every commodious farm-house, such as chaise-house, brew-house, wood-house, &c. and which it is of great importance should be regularly laid out in the first scheme of every building. Were the emigrating party to add to their store of books a copy of Mr. Waistell's "Designs for Agricultural Buildings; *including Labourers' Cottages, Farm-houses, and Out-houses,*" they would find a great deal of additional and valuable in-

formation, not only on this subject, but on many others bearing directly on the sort of pursuits in which they are about to be engaged.—EDIT.

Plans of a Farm House, Dairy, and Milking Yard, adapted to New Settlers.

BY MR. ATKINSON.

"Many persons, on first taking possession of a grant of land, content themselves with the shelter afforded by a *bark hut*, while they put in their first crops, or carry on their first and most important operations; and many, having once accustomed themselves to living in this way, will rest content with no better habitation, for perhaps several years, until absolutely compelled, by the advancing state of the population around them, to think of erecting a better. But although, in cases where the settler's capital is limited, and it is necessary to apply every shilling to the purchase of live stock, and improvement of his land, living in a bark hut may be a necessary and praiseworthy line of conduct; yet those persons who have been accustomed to all the comforts and conveniences of a good house, and especially such as have families, might, by submitting to such privation, become disgusted with the hardships of their situation; and it is certainly a prudent step for every one as early as possible to construct himself a decent dwelling; taking care, however, always to bear in mind, that in such a building grandeur and ornament must be kept out of sight, and that comfort and convenience are the only requisites to be studied. The prefixed plan (see fig. 1), will, perhaps, be found to contain all that is necessary for such a building.

"This plan comprises a sitting-room D, 14 feet by 12; three bed-rooms, A 12 feet by 12, and E and F, 12 feet by 7; kitchen B, 12 feet by 10; and store-room C, 9 feet by 5; besides a loft extending the whole length of the main body of the building; *a* and *e* are fire-places; H the main door; *h h* bed-room doors; *b* back door. A house of this kind will be found to contain sufficient comfortable accommodation for a moderate-sized family. The kitchen, store, sitting-room, and largest bed-room, are under the main roof of the building; the bed-rooms at each end are skillings or lean-to's; these may be extended out under the viranda V V V, if required. Its narrow width will allow of split wood being used for the rafters, joists, and beams; which could not conveniently be done, were it much broader, as it is difficult to run out split materials straight, when required of great length. The other dimensions of the house may be altered according to the size of the family, or other circumstances. Having selected a proper site, which should always be on rising ground, so that the house may stand dry and healthy, the next step is to mark out the dimensions, and to cut out the foundations with a spade. Some persons lay down sleepers of wood for a foundation; but the best plan is to raise a wall of rough stone, with well-tempered loam for mortar, so as to be six inches above the ground at every part, when brought to a level. Strong corner-posts should also be put down, and firmly set in the ground at each corner of the main body of the building. This plan, indeed, exposes the part in the ground to decay; but as the timbers used in the building will be green, and only roughly squared with an adze or axe, it will be difficult to joint and frame it securely; particularly as it is intended the building here proposed should be erected by common labourers, without any, or with very little, aid from carpenters; and, as it is not expected a house of this description will last for many years, setting the corner posts into the ground will give it a great degree of strength and firmness. Having completed and levelled the foundation all round, risings should next be placed upon it, properly tenoned into the corner posts, and wall plates fitted for the top all round. Grooves, about 2 inches deep and 1½ inch wide, should be cut upon the upper side of the risings and the under side of the plates, and into these

the ends of split logs or slabs should be fitted above and below to form the walls, leaving proper intervals, with posts, for the doors and windows. When the logs are all in their places, the plates may be pegged down and secured; the inner partitions may then be made in the same manner, the joists and tie-beams put on and secured, and the roof raised. Shingles are the best covering for every description of buildings in this colony (New South Wales); but proper wood for the purpose is not always at hand, and a covering of hazle will answer every purpose, until the settler has leisure to procure a better. The inside should then be lathed and plastered throughout, and also the outside under the virandas, where it is out of the weather; the exposed parts should, if possible, be weather boarded, and the floors laid with boards. Weather board may be nailed up green, but flooring board should be suffered to remain some time before it is nailed down, to allow for its shrinking. Lime is frequently a scarce article; the greatest economy must therefore be observed in using it. The chimneys may be built of stone, and well tempered loam; this also (the loam), mixed with some coarse grass, will do for the first coat of plastering; the second coat should have a portion of lime; and the whole being well whitewashed within and without, will form a very comfortable and decent dwelling. The expense will not exceed 70*l.* or 80*l.* when completed and shingled; and it may be executed by any man of common ingenuity, *without the aid of either carpenters or bricklayers.*

"A *Dairy* and *Milking-yard* are also places to the erection of which the settler must turn his early attention. An under-ground dairy is the best, and may be erected at a small expense, by digging into the south side of a hill, building the walls of rough stone and loam, and covering it with bark or shingles. Stone benches should, if possible, be formed, for the milk-pans to stand upon; and the floor should also be paved with stone. The dairy should be divided into two rooms; in one of which a chimney should be built, for the purpose of heating water to scald the utensils. The milking-yard should be situated as near as possible to the dairy. The plan (see fig. 2) is, perhaps, as good as can be devised. This plan, it will be seen, comprises two calf-pens, A and B, 16 feet by 13 each; six milking-bails C; two yards, E and G, for the cows to stand in; and a catching pen F; and will serve very well for about thirty cows. The calf-pens should be paved with stone; and if kept well littered, a considerable quantity of dung may be obtained from them. The back of the yard and the calf-pens should be enclosed with split logs, and the milking-bails and pens covered with a shed. The yard and divisions should be enclosed with a stout five-railed fence, with strong posts. D represents the main entrance; *g g g* lesser gateways; . . . . . moveable posts."

THE SEPTENARY SYSTEM.

Sir,—"F.'s" problem (No. 247, p. 250), forms the *Second* case of the *Third* class in the *Second* division of the Septenary System, in which a surface, it is supposed, may be attached to, and its motion regulated by the line A B, not only to the point B, but to any point on the plane (which may extend in every direction within a convenient distance): a pencil may be fixed to describe a line.

I suppose there is some mistake in limiting the problem to a semicircle.

I have not considered any of the curves in this case to be epicycloids (although their connexion with such lines may be traced), and there are none of the *simple* combinations of wheels that will regulate the motion of a surface in the same way.

If the point P, in "F.'s" diagram, be supposed to be in the circumference of the circle (and between the circumference and the point P a gradual connexion may be traced), the cardioid of M. Carré (see No. 231, p. 435), which is an epicycloid, will be described. See also the

reverse of this case, (No. 245, p. 216, second figure.) Both these harmonize with cases in other divisions.

Perhaps "F." will oblige your readers by giving his demonstration, and also by describing the reverse operation of his problem, which I have made the *First* case of the *Third* class in the *Second* division.

I can form a general idea of all the curves that may be produced by both cases.

To take the extremity B of any chord, is the same as selecting a point in the diameter at the distance A B from A. If the describing point be placed at B, the line described will be oblate; if at B′ (according to "F.'s" diagram), the line will be inflected; if at the distance A P from A, the line will have a cusp; and if at a less distance than A P, the line will be nodated. All these lines, or any others described by any point on the line A B, produced either way, will be in two parts symmetrical. If any point at a distance on either side of the line A B be taken, its path will be a dis-symmetrical line.

Besides this general description of the character of lines, generated by particular points, there are other interesting circumstances connected with the motion of a surface regulated on the principle of "F.'s" problem.

I am, Sir,
Yours, &c.
JOS. JOPLING.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(*Continued from p.* 250.)

22. Having endeavoured to explain the meaning and use of equations to curves, and the method of drawing them from their equations, we will return to the consideration of fluxions, which we abandoned to make this digression.

We must remember that we have obtained geometrical representations of the fluxions of curved lines, areas, and solids, and a rectangle equal in magnitude to the fluxion of a surface, though it does not depict its figure.

We will now convert these to algebraic expressions; which is a necessary step to making them serviceable for purposes of mensuration.

The lines A N, N P being here represented by x and y, N n (fig. 1, page 232), which is the fluxion of A N, and $m\ q$, which is the fluxion of N P, are denoted by the symbols $\dot{x}$ and $\dot{y}$.

23. The line P q, which represents the fluxion of the curve A P, is equal to $\sqrt{\text{P}\ m^2 + m\ q^2}$; and putting these symbols, $\dot{x}$ and $\dot{y}$, for N n and $m\ q$, we have P q, the fluxion of the curve A P$=\sqrt{\dot{x}^2+\dot{y}^2}$.

Similarly, N P $n\ m$, the fluxion of A N P, is $y\ \dot{x}$, and P P P $m\ m\ m$, the fluxion of the solid, is $c \times y^2 \times \dot{x}$; while the figure A B C D (page 233), which equals in magnitude the fluxion of the surface, will be $2\ c\ y.\sqrt{\dot{x}^2+\dot{y}^2}$; or, putting L, A, C, and S, for the length, area, content, and surface, respectively, we have

$$\dot{L}=\sqrt{\dot{x}^2+\dot{y}^2}$$
$$\dot{A}=y.\ \dot{x}$$
$$\dot{C}=c.\ y.^2\ \dot{x}$$
$$\dot{S}=2.\ c\ y.\sqrt{\dot{x})^2+\dot{y})^2}.$$

24. Since (c) which we put for the semi-circumference of a circle whose radius is unity, enters into the two last of these expressions, it appears that we can never accurately measure the contents or surfaces of figures of revolution.

25. In order to apply the expressions which we have just obtained, to the measurement of particular figures, we must get rid of the expression $\dot{y}$, by substituting for it its value in the terms of x and $\dot{x}$.

Thus, in finding the area of the common parabola, we must substitute in the expression $y.\ \dot{x}$ for y, its equivalent, $\sqrt{4\ a\ x}$, when the fluxion of the area becomes $2.\ \sqrt{a\ x}.\ \dot{x}$ instead of $y.\ \dot{x}$. Similarly the expression

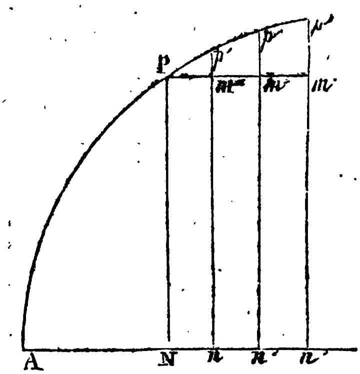
$c\,y^{\cdot 2}\,\dot{x}$, for the contents of a solid, becomes (by substituting for y^2 its value $4\,a$), $4.\ c\,a\,x^{\cdot}\,\dot{x}$.

But when we come to substitute for $\dot{y}$ in the expression $\sqrt{\overline{\dot{x}}|^2 + \overline{\dot{y}}|^2}$, or for y and $\dot{y}$ in the expression $2\,c.\,y.\,\sqrt{\overline{\dot{x}}|^2 + \overline{\dot{y}}|^2}$, their values in terms of x and $\dot{x}$, we must investigate some method of finding the fluxion of a compound quantity in terms of the simple.

Thus, to find the length of the curve whose equation is $y^3 = a\,x^2$, or $y = \sqrt[3]{a\,x^2}$, we must not only substitute for $\dot{y}$ its equivalent symbol $(\sqrt[3]{ax^2})^{\cdot}$, but we must reduce this to an expression involving only powers of x, and the fluxion of x, and not the fluxion of any power or root of x.

Similarly, to find the surface of a sphere, we must substitute $\sqrt{2rx - x^2}$ (Equation 2), for y, and $(\sqrt{2rx - x^2})^{\cdot}$ found in terms of x and $\dot{x}$, for the symbol $\dot{y}$.

26. In order to find how this may be done, we will again have recourse to a curvilinear area, A P N.



Suppose this to receive an increment P N $m_3\,p_3$; draw P m_3 parallel to A N n_3; then, according to our definition, the area P n_3 is the fluxion of A N P at N.

Now, the ratio P p_3 n_3 N : N n_3 is evidently greater than P m_3 n_3 N : N n_3.

Suppose $p_3\,m_3\,n_3$ to move into the position $p_2\,m_2\,n_2$ then it is manifest that the ratio $p^2\,n^2$ N P : N n_2 is more nearly equal to P m^2 n_2 N : N n_2, or to P m_3 n_3 N : N n_3, than, P p_3 n_3 N : N n_3; and if p_3 m_3 n_3 moves to p m n, the ratio P p, n, N : N n, approximates more nearly still to the ratio P m_3 n_3 N : N n_3; and the nearer p m n is to P N, the nearer will this approximation be. Hence, the ratio P m_3 n_3 N : N n_3 is the limit to which the ratio P p, n, N : N n, of the respective increments P p, n, N, and N n of the area and axis continually approaches.

Hence, since P n_3 N n_3 are the fluxions of the area and axis, the ratio P n_3 : N n_3 is the ratio of the fluxions; and as P n_3 : N n_3 is the limiting ratio of the increments, we obtain this theorem :—

The ratio of the fluxions of two quantities is the limiting of their increments ;—which is equally true in all other cases.

Some examples of this we shall give in our next.

(To be continued.)

REMARKS ON BROWN'S GAS VACUUM ENGINE.

BY DR. JONES, EDITOR OF THE "FRANKLIN JOURNAL."

It is now upwards of three years since Mr. Samuel Brown's gas-engine was introduced to public attention; and, from the ingenuity of its construction, and the sanguine expectations of the projector and some of his friends, it excited an unusual degree of interest. The principle of its action was by no means novel; the production of a partial vacuum by the combination of explosive mixtures of atmospheric and inflammable air, had been long spoken of, as a substitute for that power obtained by steam. In the year 1814, a model of an engine acting upon this principle was placed in the hands of the Editor, with a view to his instituting some experiments with it. The inflammable gas to supply it, was to be obtained from the charring of wood; and it was imagined, that the charcoal produced, would go far in defraying the expense of working

it. The model was rudely made, but appeared to work with considerable power, and the subject would have been pursued, but for the removal of the Editor to Virginia; on which account the model was returned to the inventor, and it is believed that no further effort was made to perfect it, and thus, the time and money which would probably have been uselessly expended upon it, were saved.

Since that period, several attempts have been made to apply the same principle, either by using inflammable gases, or the vapour from fluids which are volatile and combustible; hitherto, however, these efforts have been unsuccessful, and we have strong doubts, whether, under any ordinary circumstances, an engine operated upon by an explosive mixture of gas, or vapour, will ever be constructed, which will successfully compete with the steam engine.

The want of success, which has attended the ingenious and persevering efforts of Mr. Brown, renders it less necessary to urge our objections, than it would have been two or three years ago. There does not appear, in the successive attempts to perfect this engine, any deficiency of genius, perseverance, or funds; and yet, so far, we believe, it must be pronounced to be a failure. One of the main difficulties which has been experienced, has arisen from the large quantity of gas consumed, which has, to an enormous extent, exceeded the calculations originally made; such, at least, is the information which we have received, and that from sources entitled to credit.

We have spoken of this engine as a failure; we ought, however, to state, that such is not the opinion of the inventor; an engine upon Mr. Brown's principle has recently been constructed in this city (Philadelphia), by his son, who came from England for that purpose, under the patronage of one of our most respectable fellow citizens. This engine, although not actually completed, is so far so, as to have been set in operation; the question of its value, in the form it has now assumed, will, therefore, soon be settled. Mr. Morey is also here, with the design of completing one of his explosive engines, an account of which we formerly published. This, in its structure, differs considerably from Brown's; it has two cylinders with pistons; these cylinders are alternately filled with air and vapour from heated spirits of turpentine; this mixture, when ignited by a taper, explodes, expelling nearly all the air through an opening in the bottom of the cylinder, which bottom is formed of leather, in such a way, that it operates as a large valve, allowing free exit to the heated and expanded air, and closing so as to prevent its return; the pressure of the atmosphere operates upon each piston, alternately, as it would in an ordinary atmospheric engine with two cylinders.

Engines, analogous in principle to the ordinary steam engine, but acted upon by the elastic force of vapour from different volatile liquids, have also been constructed, or proposed; and several patents have been obtained for them. The objections to these appear to us to be insuperable; for although there is no theoretical obstacle in the way of their operation, the practical difficulties which present themselves have hitherto caused, and are likely to ensure, the abandonment of all such attempts: whenever we meet with accounts of such in the journals, we expect the same fate to attend them, which we know await those numerous advertised *improvements* which sin against the established laws of nature; not that we esteem them alike absurd; alcohol, ether, quicksilver, or any other volatile fluid, may be used to work an engine; the attempt, therefore, to employ them, is a legitimate object of pursuit, its attainment is within the bounds of possibility, and although it may ultimately fail, the effort may yet reflect great credit on the individual who makes it.

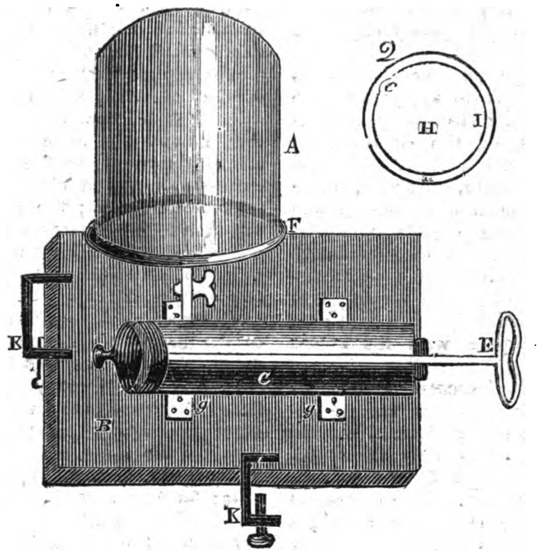
IMPROVED AIR-PUMP.

Mr. Editor,—At page 233, vol. vi. of your valuable Magazine, you give

a drawing and description (from the "Edinburgh Philosophical Journal") of an air-pump *without valves*, invented by W. Ritchie, A.M., Rector of the Tain Academy.

Being a worker of metals, I have made a pump with a one-inch barrel from your description and drawing, which I find will exhaust a receiver to as great an extent as pumps with valves, as made by the opticians, and at a comparatively trifling expense.

But there are some inconveniences attending the working of Mr. Ritchie's pump:—1st. The barrel and piston



are perpendicular; and, being worked by hand, the operation is both laborious and painful, where there is much work to be performed. 2d. When the piston in the down-stroke arrives at C, in your drawing, the air from C to B not being able to escape, I have found it very difficult to (and, indeed, cannot) press the piston to the bottom of the barrel, although I effect a partial communication between the barrel and the pump plate; and after the second or third stroke of the rod, the difficulty ceases, in consequence of the air being more rare, which enables me to condense it at C and B sufficiently with the piston to open the usual communication between the barrel and plate. It is to obviate those inconveniences (or difficulties) that I send you the prefixed drawing and dimensions of two or three air-pumps that I have lately made, and which, *in practice*, are found much superior to the original pump.

B is a flat slab of mahogany, or any other wood, 1 foot by 10 inches, and 1 inch thick.

C, the pump barrel, drawn or bored perfectly true, 12 inches long, 1¼ inch in the bore (or diameter), of brass, with a solid brass end, and a stuffing box, or collar of leather, on top.

F is the brass pump plate, ground very smooth, 1-8th of an inch thick, communicating with the barrel C by a small 3-8th or half inch brass tube, in the centre of which is a cock.

A, the glass receiver, ground smooth to the brass plate.

D the piston, 1 inch long, so as to present sufficient surface to the barrel to ensure its being air tight.

The piston rod and handle E are each of brass, the rod about the diameter of No. 1 wire gauge.

g g are brass straps, soft soldered

to the barrel, which are secured to the mahogany with screws.

K K are two iron claws, to make it fast to a table, &c.

H, fig. 2, is a section of the lower part of the barrel, where the piston D now rests.

I, its thickness in brass.

e is a small notch cut in the inside of the barrel, below the pipe that leads to the plate, so that when the piston is pressed down, the air at the bottom may escape from under it to the top of the barrel, and so be pumped out with the next stroke of the rod.

Any mechanic wishing to make a pump upon the above construction, will find the dimensions I have given quite large enough; *and by the horizontal working* of the barrel, he will find it quite easy; so much so, that he may sit down to his experiments, and exhaust the receiver likewise. For the simple manner in which the pump is worked, I refer him to page 233 of vol. vi. of the "Mechanics' Magazine."

I am, Sir,
Yours, &c.
RICHARD EVANS.
Swansea, April 26.

HYDROSTATICS.

Sir,—On page 231 of the third edition of "Webster's Mechanical and Chemical Philosophy, it is stated as follows:—"For example, a hogshead of water capable of descending from a height of ten feet, possesses the same power as ten hogsheads falling from the height of one foot; *and a cistern filled to the height of ten feet above the aperture, possesses one hundred times as much power as the same cistern filled to the height of one foot only.*" This I conceive to be fallacious, and shall be obliged if some of your ingenious correspondents will explain or point out the fallacy.

I am, &c.
H. H.
Bowbridge, April 5, 1828.

ON THE CONSTRUCTION AND USE OF MICROSCOPES.

There is this difference between the microscope and telescope, that the most powerful microscope may be made by a schoolboy for a farthing, while the most powerful telescope requires the genius of a Herschel, and the patronage of a king, to raise it.

There is a mistaken notion which has gone abroad (no doubt encouraged by the mathematical instrument makers), that it is necessary to give a good round sum for a powerful microscope. Now, the fact is, that the most delicate and difficult test object is best seen in the single microscope. To be sure, it is a very imposing sight to see the shadow of a flea (thrown by the solar microscope), on a screen, as large as a calf; but it is by no means so sharp, or well defined, as in the single microscope. The only advantages attending the other expensive microscopes, such as the Lucernal compound lantern, are, that the objects may be measured by a micrometer, or traced on a grey glass, and there is also a larger field of view; but what is gained in quantity is lost in quality. I shall begin with the

High Power.

The reason that globules are not generally used is, because they are not always carefully selected, or made too large, or improper objects applied to them.

Take a piece of good crown window-glass; cut it into strips, as narrow as possible, with a diamond. Clean them well, and draw them out with the blow-pipe into the shape of the annexed figure. Break them at

the thin parts, without touching them with the finger, and melt the ends in the outer part of the flame into globules from the 60th to the 20th of an inch in diameter; hold the globule with clean leather, or silk paper; touch them with a file about 1-16th of an inch from the ends; break them off, and try them. The best object for this purpose is the outside skin of the eye of the great dragon fly, laid flat between two of the thinnest pieces of talc. Perhaps out of three dozen globules, one dozen will be fit for use.

Medium Power.

Take a *good* middle-sized globule; fix it with sealing-wax into a small cavity in the end of a wooden skewer. Grind full one half of it away on a stone; then figure it roughly, so that it may not be so convex as the natural surface. Make a corresponding cavity in an oil-stone; then figure the lens, by giving it cross strokes in all directions, and then a few circular ones, till it appears of a good figure. Proceed in the same manner on a hone (such as razors are set upon), till it appears of a uniform figure all over the surface; then warm a piece of sealing-wax, and press the lens against it, to form a tool to polish it in, which is best done with a little washed jeweller's rouge, or putty. Examine it with a lens about 1-4th of an inch focus; and when it appears free from scratches, and uniformly polished all over, just moisten it with the tongue, and finish it as before directed, with the powder that is left in the tool; or you may take a large globule, and grind, figure, and polish it into a plane convex lens. But this surface is more difficult than a spherical one. To do it properly, two hones must be used to figure it upon; that is to say, the second hone is necessary to keep the first one flat. The glass should be figured upon both of them, and the hones should be often ground together, till all three surfaces appear as flat as possible. It may then be polished.

Low Power.

Take a square piece of the same glass, 1-8th of an inch diameter. Chip and grind it first round; then fix it on the end of a cedar pencil; grind, figure, and polish it as directed, and then the other side in the same manner. Or take a piece of new plate glass, 1-6th of an inch diameter, and form one side of this into a lens for a lower power.

After the lenses are polished, they should be boiled in a watch-glass, with a little spirits of wine. It requires more patience than skill to make the lenses; as two irregular bodies, one concave, and the other convex, if ground together, will form a true spherical surface, especially if the person walk round the tool and turn the lens as much the contrary way. But as some of your readers may not be inclined to make them, or to fit them to a proper screw adjustment, they may see the animalculi in stagnant water, without either one or the other, by the following means:—

Take a piece of jet, or brass, 1-10th of an inch thick, made flat and smooth on both sides; drill a hole through it 1-30th of an inch diameter. If this is filled with stagnant water, by a capillary glass tube, so as to have a hemisphere on each side, the animalculi may be seen in the aqueous lens itself, if it is held over a light. A drop of water will form a very good temporary lens. Fit a piece of jet, 1-16th of an inch thick, into the arm of a microscope; drill a hole, 1-30th of an inch diameter, in the centre; form a hemispherical cavity, 1-8th of an inch diameter, on one side, and one of 1-16th on the other, and so deep as to reduce the edge of the hole to a sharp edge. In these cavities pure water must be placed, but it must not extend beyond the edge of the cavities. Fluid lenses may also be formed of pure Canada balsam, castor oil, turpentine, varnish, &c. For this purpose, fit a piece of thin plate glass into the arm of the microscope, and a piece of flat brass, with a hole in the centre, 1-30th of an inch diameter;

place a drop in the centre of the glass; put the glass into the arm, with the lens downwards, and lay the brass over it. The brass may be blackened by rubbing it over with boiled oil, and then baking it over a candle.

(*To be continued.*)

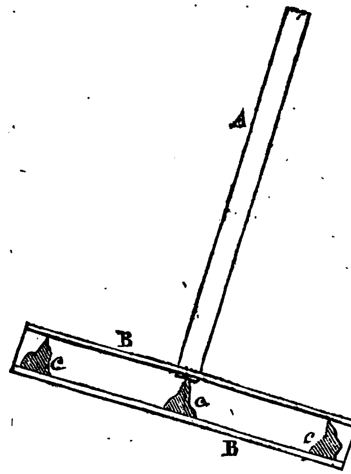
CURIOUS PHENOMENA RESULTING FROM ATMOSPHERIC PRESSURE.

Sir,—In a recent Number of the "Salisbury and Winchester Journal," it was stated that the following curious fact had puzzled all the members of the Royal Society, and that 100 guineas and a medal were to be the reward of the successful discoverer. Whether or not this statement be correct, it is well worthy the attention of your mechanical correspondents. I should be glad to see it satisfactorily explained in your pages.

"Cut a couple of cards, each into a circle of about two inches diameter. Perforate one of these at the centre, and fix it on the top of a tube,—say a common quill. Make the other card ever so little concave, and place it over the first, the orifice of the tube being thus directly under, and almost in contact with, the upper concave card. Try to blow off the upper card;—you will find it impossible."

A similar fact has lately occupied my attention, which I consider more unaccountable than the preceding one.

Take the bottom pieces of two thin wooden pill-boxes of the same diameter. Perforate one of these in the centre, and insert the end of a quill (as before). On the other, drop a little sealing-wax in three or four places, at equal distances, near the edge. Form the wax into little elevations about a quarter of an inch high, so that they may all touch the other piece, when placed on it. Then hold the piece with the wax on it against the other;—on blowing through the quill, and letting go the under piece, it will not fall off, but remain firm as long as you can continue blowing. Pins stuck through the piece will do, if they are firm, as well as the points of wax.



A represents the quill; B B the pieces; *c c c* the points of wax.

W. H. B.

Ringwood.

We need scarcely observe, that the statement in the "Salisbury and Winchester Journal," alluded to by our correspondent, is wholly apocryphal. The circumstance which we make no doubt gave rise to it, was the notice which appeared in our own and other Journals, of an observation made by M. Clement Desormes (see "Mechanics' Magazine," No. 218, p. 237), that when steam issues in a violent jet through an orifice of a boiler, if a flat metal disk is brought close to the orifice, it is not driven away, but is attracted, as it were, towards the hole, and remains suspended in the midst of the current of steam, in opposition to its natural gravity. The cause of this phenomenon was afterwards very fully investigated and explained by M. Hachette, of whose papers on the subject the following abstract is given in the "*Annales de Chimie*," vol. xxxv. p. 34:—

"The first simplification of M. Hachette was to make the nozzle of a pair of double chamber bellows terminate in the middle of a flat plate; he found that when the bellows were worked, effects were produced opposite the jet of air, of the

kind described by M. Desormes; namely, that disks of card, and other substances, were drawn towards the aperture, against the direction of the current. At the same time that he described this experiment, he also announced his having produced the same effects by using a stream of water instead of a stream of air. The apparatus was still further simplified, so as to make a stream of air from the mouth sufficient to produce the effect. A tin tube A, fig. 1,

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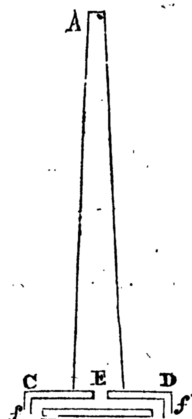
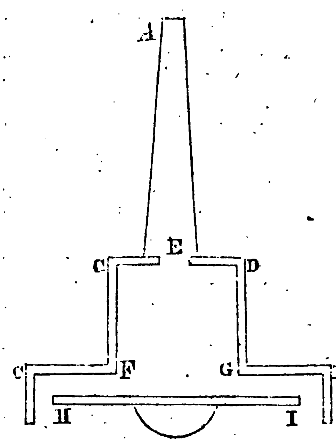


was soldered to the middle of a round tin plate, in the centre of which was a small orifice E; three or four small projections of the tin *f f*, were left at the edges of the plate, to prevent the disks of paper, card, or metal, from slipping off sideways. Instead of the tin plate, a piece of smooth cork may be used; and for the tin tube, a glass tube, or one made by rolling up a piece of paper. If the tube be held horizontally, or inclining a little upward, and a disk of card or paper be placed loosely against the aperture in the plate, it will be found that on applying the mouth to the end of the tube, and blowing air through, the disk will not be driven away, but actually made to apply closely to the surface of the plate; and if turned towards the ground, it will be found to remain opposite the hole, and not to fall until the current of air is stopped. Even a plate of tin may in this way be suspended by a current of air; which at first would be supposed to conjoin with gravity in forcing it to the ground. When the disk is flexible, and slightly elastic, a heavy sound, and sometimes even a shrill tone, is produced by the vibrations of the plate.

"M. Hachette, in explanation of these experiments says:—'The air is pushed from the mouth A of the tube, towards the orifice E of the plate; it strikes the part of the disk opposed to this orifice, and the mean pressure on that part is greater than the pressure of the atmosphere. The blown air then takes place of that between the plate and the disk opposed to it; it moves in this interval with a velocity decreasing from the edges of the aperture; the elastic force of this air decreases at the same time, so that its mean pressure between the plate and the inner face of the disk becomes less than the atmospheric pressure; and as this last pressure is exerted on the whole external face of the disk H I, this disk being subject, at one and the same time, to the two contrary pressures on its opposing faces, obeys the greater, and is pushed towards the plate C D.

"It is not necessary that the disk C D should be near the orifice E of the tube A E. Let fig. 2

2



be an instrument composed of a

hollow cylinder C D F G, and a flat border of the dimensions C F or G D. Let a tube A E be fixed to the bottom of the cylinder, the orifice E having a diameter of about three millimetres (0·12 of an inch). If air be blown in at A against the disk H I in the neighbourhood of the flat border, the disk will be urged towards the orifice E."

ANSWER TO THE INQUIRIES OF A CORRESPONDENT ON FLY-WHEELS.

Sir,—I have only to-day seen the request of one of your "Grateful Subscribers," (No. 241, p. 157); in answer to which, I shall first suppose the fly-wheel and circular saw to be fixed upon the axis of the pinion, making 24 revolutions per minute; I then expect the rim of the fly-wheel will have a velocity of 454 feet per minute, = 7·6 feet per second; and the circular saw, a velocity of about 216 feet per minute, = 3·6 feet per second. The fly-wheel considered to be 6 feet diameter, rim 6 inches by 3 inches, and about half a ton weight. In less than two seconds the accelerating force of the fly-wheel will equal the velocity of the driving wheel. But as this motion would be too slow, I would advise a 6 feet diameter wheel to be fixed on the axis of the 2 feet pinion, to drive a second 2 feet pinion, on which axis fix the fly-wheel and circular saw, which will make 72 revolutions, per minute, each. In this case the fly-wheel may be 6 feet diameter, rim 3 inches by 1½ inch, and about 3 cwt. in weight; it will have a velocity of 1370 feet per minute, or 23 feet per second. The accelerating force will require 2½ seconds of time to equal the velocity of the driving power, after which it will act negatively and positively, according to the variations of the moving power. The horse walk should not be less than 24 feet diameter, and I have calculated for the horse to make 3 revolutions per minute.

I am, Sir, &c.
WM. ANDREWS.

Tring, Herts, May 1, 1828.

SUPERIOR COATING FOR CANVAS.

Sir,—I have just seen, in No. 208 of your most valuable work, an inquiry for a varnish, or coating, for canvas, that will combine the qualities of lightness, durability, imperviousness to rain, pliability, and cheapness. I beg to inform your querist that the following very simple preparation will supply all these wants in a most effectual manner:—

Put half a pound of lime in powder into any convenient vessel that will receive the blood of a sheep as drawn by a butcher; stir it well, and apply it immediately on any linen or cotton cloth, by rubbing it well into the pores with a piece of rag. If the cloth is stretched on a frame, it will be the more even. Let it dry; and, when thoroughly so, it is fit for use, and may be blacked with lamp-black and oil, and will take as high a polish with a brush as leather.

I mention the blood of a sheep, as it marks the quantity of lime, but, of course, any other blood will do equally well.

The above preparation is well understood by all soldiers, who served at the Cape of Good Hope during the last war.

AN OLD SOLDIER.

NEW PUBLICATIONS

Connected with the Arts and Sciences.

Elements of Geometry, with Notes, by J. R. YOUNG. pp. 208. 8vo. 8*s*.

We some time ago (see No. 184) recommended to the notice of our readers a little work, entitled "Popular Geometry," by Mr. Darley, which was compiled on the plan of extracting from "Euclid's Elements" all that was really useful, re-embodying it according to a more natural order of arrangement, and only deviating from the original where it is most strikingly erroneous or defective. We have now before us a work, which aspires to occupy the place of Euclid altogether; and professes not only to avoid the errors of that illustrious mathematician, but to take "a more enlarged and comprehensive view of the elements of geometry than has hitherto been

done," either by Euclid or by any one else. (*Pref.* p. vii.) A more modest announcement would have pleased us better; but, pretension aside, Mr. Young's work is, in truth, a production of a very superior description, and well entitled, by its intrinsic merits, to the high character claimed for it.

Mr. Young exhibits, on a larger scale, the same original and independent tone of thinking, which we had occasion to commend so highly in the case of Mr. Darley. He has neither suffered any slavish devotion to authority to bias his investigations, nor any mere love of change to seduce him into new paths. Whatever he has found really worthy of adoption in preceding writers, he has readily adopted; and it is only where they have decidedly failed, that he has endeavoured to substitute something better of his own.

The most difficult subject in the whole compass of mathematics is, undoubtedly, the doctrine of Proportion; and it is that on which, much to Mr. Young's praise, he appears to greatest advantage. For a period of more than two thousand years have geometers been baffled in all their attempts to expound it clearly and intelligibly. The reasonings of Euclid on the subject are so exceedingly subtle, complicated, and obscure, as to be quite beyond the comprehension of ordinary minds; while Legendre, the first of modern geometers, has passed it over altogether, on pretence that the student may find all the information that is requisite respecting it in any "of the common Treatises on arithmetic and algebra" (Brewster's Translation, p. 48); whereas even the best books on arithmetic and algebra unfold the properties of proportion only as regards numbers, and such magnitudes as, like numbers, are commensurable and homogeneous. The doctrine requires to be established in a way *universally applicable*, so that magnitudes of all kinds may be included, without any restrictions or arbitrary conditions whatever; and this is what Euclid has done: it is his method only of doing so which is faulty, because hard to understand. Mr. Young, who devotes his fifth book to this subject, has grappled most manfully and ably with the difficulties which embarrass it, and succeeded better, than any other author, with whom we are acquainted, in overcoming them. He has contrived to arrive at the same general conclusions as Euclid, by a much shorter and simpler process. For the minutiæ of that process, we must refer the reader to the work itself; but it may suffice to mention generally, that Mr. Y. dispenses entirely with those subsidiary propositions relative to ratios, in which Euclid's greatest subtleties of reasoning are involved, and, indeed, abandons the use of the term *ratio* altogether; giving this sensible reason,—that as the term ratio "denotes, in reality, the quotient arising from the division of one magnitude, or quantity, by another of *the same kind*," it is only "accurately assignable when the magnitudes are commensurable," and not so when "*they are incommensurable*." Mr. Y. acknowledges that this method of treating proportion was suggested to him by the "*Principes Mathematiques*" of M. da Cunha; a work of great ingenuity and learning, which was first introduced to the notice of English mathematicians by the late Professor Playfair, in the "Edinburgh Review," vol. xx. But although it is owing to this suggestion that Mr Y. has steered clear of the numerous perplexities arising from the comparison of ratios, the mode of reasoning which he has substituted in lieu of it, is not only wholly different from that adopted by M. da Cunha, but a great deal more simple and complete.

Among other instances of similar acuteness and originality exhibited by Mr. Young, we may notice his manner of treating the 7th proposition, book vi. of Euclid (that "triangles are similar which have an angle in each equal, and the sides containing another angle proportional, provided the third angle in each be of the same character"). Mr. Thomas Simpson, in his edition of Euclid, thought proper to omit this proposition altogether, as being incapable of demonstration, and substituted another in its place, which really was so—being in fact absolutely false. The erroneous proposition, thus absurdly interpolated, appears also in the more recent work of Mr. Leslie (prop. xiv. book vi.) Mr. Young has not only restored the original proposition, but supplied a very neat and satisfactory demonstration of it. For proofs of all this, we refer the reader to prop. xii. book vi. of Mr. Young's Elements, and the note upon it, p. 199.

The general, and most important feature of distinction between Mr. Young's Elements, and all other English works of the same kind, is the care which he has taken to demonstrate the *converse* of every proposition, when that is possible; and explaining why that cannot be done, when such is the case. Of the great

utility of this plan, there cannot be two opinions. The student is by this process taught, not only that under particular conditions a certain property must have place; but also, whether or not it is possible for the same property to exist under any change of these conditions; and by thus applying his mind to every possible view of the subject, must acquire a mastery over it not attainable by any other means. There is a French System of Geometry, by Develey, in which this plan has been partially followed; but the present is, we believe, the first instance of its being adopted in this country.

The point in which Mr. Young resembles his predecessors most, and with least credit to himself, is the frequent insufficiency and superfluousness both of his "definitions" and "demonstrations." He does not insist so positively as others have done, on a point being nothing, length nothing, breadth nothing, thickness nothing, and a surface of a collection of such nothings; but he has other things quite as absurd, by dwelling on which alone, to the neglect of the substantial merits of the work, a facetious critic might, like a certain defunct contemporary, make Mr. Young look ridiculous enough. Such grave *dicta* as that "the whole is greater than a part,"—"the whole equal to the sum of the parts into which it is divided;" that "any line inscribed in a circle, lies wholly within that circle;" that "one circle *touches* another when their circumferences have one point in common, and only one" (they could not possibly have *two*), &c.; —can only be defended on the ground, that when things are as self-evident as they can be, or as plain as they need be, for persons of the commonest understanding, they may be rendered still more so by words (to say nothing of diagrams) which convey no new meaning whatever. Mr. Young would do well to free his work from all such specks as these, before it reaches (which it will no doubt soon do) a second edition.

It is necessary to observe, that the book, which we have now before us, comprehends but one general branch of the Science of Geometry, namely, that which treats of lines supposed to be all situated in the same plane; and that Mr. Young proposes to publish shortly a Second Part, containing "the Geometry of Planes and Solids, with Notes; and an Appendix on the Symmetrical Polyedrons of Legendre."

MISCELLANEOUS NOTICES.

Pulsation.—The average number of pulsations in an adult man, in good health, between thirty and forty years of age, is estimated at about seventy-three in a minute; but the pulses of women, at about the same age and condition, are somewhat quicker. Kepler, who estimated the mean pulses of man as seventy in a minute, estimated those of women at eighty, or at one seventh more; and Dr. Falconer considers the difference to be in about the same proportion, calculating the ordinary pulses of men at seventy-five, and those of women at eighty-four. Dr. Bryan Robinson has given a Table of pulses according to stature, taking six feet as the standard, at which height he found the pulse to be sixty-five, and computing upon this rule, which he says was founded upon a great number of observations, he concluded that the mean pulses of well proportioned bodies, were to one another inversely as the biquadrate roots of the cubes of the length of the bodies. Senac held a similar opinion, but his computation was somewhat different. He gives the following proportions:—At two feet, pulse ninety; at four feet, eighty; at five feet, seventy; and at six feet, sixty. The last number, he says, was deduced from observations made on one hundred men of the Royal Guards, who were selected for the purpose, on account of their tallness of stature.

Durable Paste.—Mineralogists and others, who have frequent occasion to use paste for labels, &c. in very small quantities, and who find the trouble of thus making it on every fresh occasion inconvenient, will be glad to know that this useful article may be made to keep even for years, always ready for use, and subject to no change. That which I have long used, is made of flour in the usual way, but rather thick, with a proportion of brown sugar, and a small quantity of corrosive sublimate. The use of the sugar is to keep it flexible, so as to prevent its scaling off from smooth surfaces, and the corrosive sublimate, independently of preserving it from insects, is an effectual check against its fermentation. This salt, however, does not prevent the formation of mouldiness; but as a drop or two of oil of lavender is a complete security against this, all the causes of destruction are effectually guarded against. Paste made in this manner, and exposed to the air, dries without change, to a state resembling horn; so that it may at any time be wetted again, and applied to use. When kept in a close covered pot, it may be preserved in a state fit for use at all times.—*Dr. J. Mac Culloch.*

Twist off the Crowns of Pine Apples, if you wish to have the apples in perfection. They are generally suffered (for the sake of ornament) to remain and to live upon the fruit, till they suck out all its goodness. A pine apple ("Brande's Jour. N. S. iii. 229) will keep for a long time when its crown is removed, and will also be greatly improved in flavour, since the more aqueous parts of the fruit evaporate sooner, and leave it much more saccharine and vinous in its flavour; a process totally obstructed by the vegetation of the crown, on the same principle that an onion or carrot loses its flavour when it begins to sprout in the spring.

Influence of the Moon on Plants.—There is an impression very general among gardeners, that the light of the moon has an injurious effect on plants, especially in the months of April and May. M. Arago has shown this notion to be erroneous, but accounts for its general prevalence in a very natural way. ("*Annuaire du Bureau des Long.*" 1827.) He has demonstrated that though there can be no reason to suppose that the light of the moon has any direct influence on vegetation, it must follow, from the well established princi-

ples which govern the circulation of heat, that during clear moonlight nights, plants are more liable to be nipped by cold, and turned brown (whence the name of *lune rousse*, given by the French to the moon which, beginning in April, becomes full either at the end of that month or in May), than when the nights are dark and cloudy. He refers to the investigations of our own countryman, Dr. Wells, *on Dew*, for the proof of the fact, that exposed bodies may frequently have their temperatures reduced six, seven, and even ten degrees below that of the surrounding atmosphere, *by the effect of radiation alone*, but that when the heavens are obscured, radiation to such an extent does not take place. He then observes, that as the temperature in the months of April and May is often not more than four, five, or six degrees above the freezing point, it must follow that when the moon shines bright, and *radiation to its utmost possible extent takes place*, the temperature of plants may, by this means, be often brought four, five, or six degrees *below* the freezing point, whilst the circumambient air is *above* it. Of course, there need be no wonder, that even in the genial month of May plants should sometimes exhibit all the withering influence of icy December.

Phosphorus Light extinguished by Essential Oils. The solutions of phosphorus in *fixed* oils produce, it is well known, a very brilliant effect, but M. Walcker has remarked (*Annal. der Phys.*), that the luminous power which they possess, is instantly destroyed by the addition of small quantities—in the proportion of fifty to one—of any of the essential oils, of turpentine, rosemary, bergamotte, lemon, camomile, angelica, juniper, parsley, and nutmeg. The oils of aniseed, cajeput, lavender, rue, sassafras, fern, cascarilla, mint, orange flowers, fennel, valerian, cherry laurel, and bitter almonds, and the balsam of copaiba, have the same property, but in so inferior degree, that they must be added in the proportion of a fifth; while the oil of cinnamon, rectified petroleum, balsam of Peru, and camphor, do not in the least affect the luminous power of the solution of phosphorus.

Recovery of Drowned Persons.—M. L. D'Etoiles states, in a letter to the French Academy of Medicine, that he has succeeded invariably in recovering drowned animals by the following galvanic application. A short and fine needle is inserted into the sides of the body, between the eighth and ninth ribs, so as to come in contact with the attachment of the diaphragm, and then a current of electricity, from twenty-five or thirty pair of inch plates, is passed through them. The diaphragm then immediately contracts, and an inspiration is effected. On breaking the communication, and again completing it, a second inspiration is occasioned; and by continuing these means, a regular respiration is ultimately effected.

NEW PATENTS.

Peter Taylor, of Hollinwood, county of Lancaster, flax-dresser, for certain improvements in machinery for hackling, dressing, or combing flax, hemp, tow, and other fibrous materials.—29 March—6 months.

John Davis, of Leman-street, Goodman's Fields, sugar refiner, for an improvement in boiling or evaporating solutions of sugar and other liquids.—29 March—6 months.

MINOR CORRESPONDENCE.

Circulating Decimals.—Sir,—In No. 248, at the end of your "Minor Correspondence," I am accused of writing with angry feelings. Had this accusation been just, I should have stood corrected: but the letters referred to do not, I conceive, merit the *censure* your correspondent has been pleased to pass on them. For what, I would ask, had I cause to be *angry?* Was it any *mistatement* on the part of the gentleman whose letter I answered, that I was not able to refute? or did I advance any position that I was not able to maintain? In respect to the errors in the Tables alluded to, a few unlucky notes of admiration (!!!) have, I presume, given your correspondent an idea of my assuming the tone of triumph, in which *he says* they are proclaimed. I am, however, much obliged to your correspondent for the high *encomiums* he has been pleased to pass on my *mathematical erudition* and *acuteness*, and remain, Sir, yours truly,

Lynn, 19*th May*, 1828. J. Utting.

P. S. If any *apology* is necessary on my part, I consider it due to Dr. Gregory. Should a second edition of Dr. Gregory's "Mathematics for Practical Men" be required, I have not the least objection to furnish a copy of my Tables, if they meet Dr. G.'s acceptance, as a *substitute* for the *apology* (provided they are not published by the Astronomical Society). My Tables would occupy about 36 pages *octavo*. J. U.

The New London Bridge.—Sir,—Encouraged and gratified as I have been by your insertion in the "Mechanics' Magazine," of a hint for the widening of the New Bridge (vol. iv. pages 203 and 288), and by the attention which was paid to it,—the bridge having been afterwards made six feet wider than was at first intended,—I now beg to offer a farther observation with respect to the guard of the bridge, commonly called the balustrade. Passing by the other day, I saw two models of balustrades set up on one of the arches, as if for public inspection, or for the purpose of the gentlemen concerned viewing, and choosing between them. Permit me to say, this is doing things as they ought to be, and accords with another recommendation of mine ("Mechanics' Magazine," vol. iii. p. 363), that the plans of all *public* works should be submitted to *the public*. By no means would I now finish with close work; which I believe was the first plan, as is seen by one of the models. Having added six feet to the width of the bridge, this will obviate the obstruction that was foreseen would attend the first plan; namely, the loitering and gazing at objects through the balustrades, to the annoyance of persons in the due exercise of business. Supposing it may occur, now and then, that persons, two or three deep, may be endeavouring to get a peep at something going on on the water, still, by the additional width, you will have room to pass without much inconvenience, while the open balustrading will unquestionably be more ornamental than any other.—I am, &c. T.

6, *East Place, Lambeth, May* 5, 1828.

INTERIM NOTICES.

We shall endeavour to resume, and we hope conclude, the subject of Fire Escapes, in our next.

H. F. **** papers are intended for insertion.

Communications received from a Constant Reader near Stockton—Mr. Baddeley—J. S. S.—R. Godolphin, Mr. Brew—F. F. Jonathan, and T. E.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-Row, London.

Printed by G. Duckworth, 76, Fleet-street.

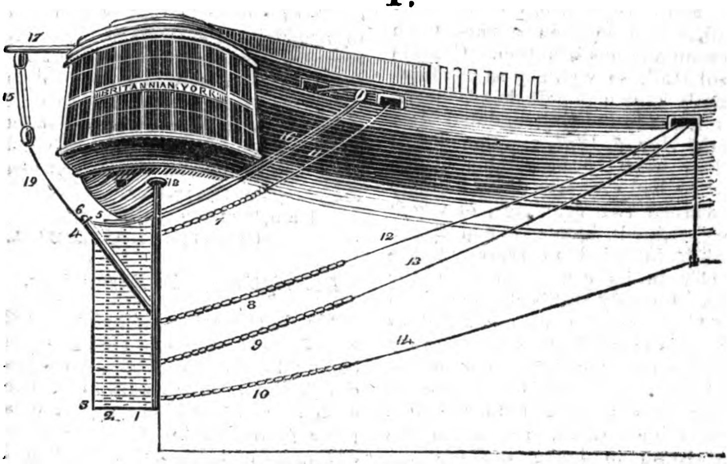
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 250.] SATURDAY, MAY 31, 1828. [Price 3*d*.

"Every new discovery may be considered as a new species of manufacture, awakening moral industry and sagacity, and employing, as it were, a new capital of mind."—*Edinburgh Review*, No. 92.

PLAN OF A TEMPORARY RUDDER.

1.



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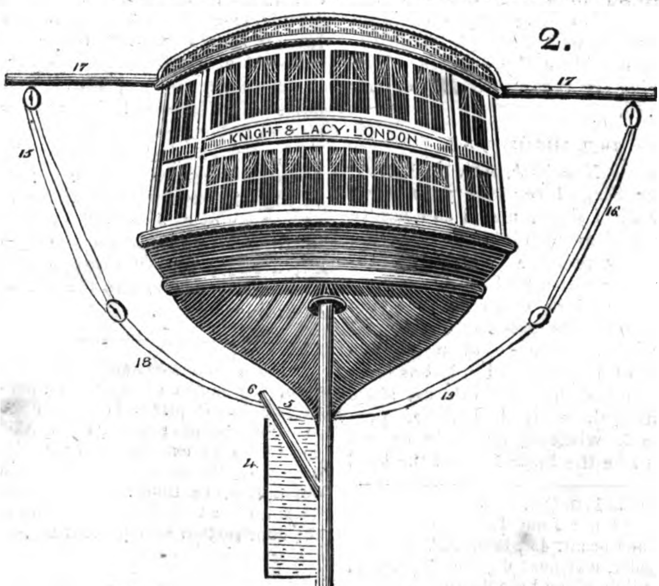


TEMPORARY RUDDER.

(*From the "American Journal of Science and Arts."*)

The public papers have recently informed us of the circumstances which led to the invention of a temporary rudder, fitted at sea to the Liverpool Packet Britannia, by her commander, Charles H. Marshall;* and of the great satisfaction expressed by the passengers with the skill and intrepidity of Captain Marshall, which so soon rescued them from an anxious situation. Captain Basil Hall, so well and so advantageously known in both hemispheres, in a letter to the Editor, dated New York, Nov. 5, 1827, mentioned this rudder as "the best thing of the kind he had ever seen;" and kindly forwarded two drawings, of which the prefixed figures 1 and 2 are copies, intended to represent the rudder in its connexion with the ship. Captain Hall's opinion, from his high standing as a nautical as well as a scientific man, being a very decisive recommendation of the utility of Captain Marshall's invention, a letter was addressed to the last named gentleman, requesting his permission to make the drawing public, and asking any additional information which might be necessary to elucidate the subject. The following is the substance of his reply:—

TO B. SILLIMAN, ESQ.

New York, Nov. 15, 1827.

Dear Sir,—I received your letter a few days since, and I can assure you I feel great pleasure in giving you every possible information respecting the fitting of my temporary rudder; and in order to give you a full idea of its construction, I must beg your acceptance of a wooden model of the original. It has been examined with great interest since my arrival, and, I believe, pronounced, without a single exception, to be the best thing of the kind ever adopted. I consider the knowledge of this so simple, so easily made, and requiring so little material, and one that can be shipped in a tolerably moderate sea, particularly valuable to all nautical men. I was not more than twelve or fourteen hours in making it and fitting it to its place; and I found it would steer, veer, and stay the ship with as much ease as the former one. You will observe the piece across the top of the rudder-post; that is intended to fit under the earlings of the deck, provided it is necessary to have anything to keep it down; and if it is necessary to have anything to sink it down to its place, the end of a chain cable may be used,—the end of it being lowered down between the planks of the rudder.

I am, Sir, yours, &c.

CHARLES H. MARSHALL.

* On the 17th Oct. 1827, when twenty-three days out from Liverpool to New York, and in lat. 45°, long 52°, she lost her rudder, and next day was fitted with the temporary one here described.

Description of the Engravings.

No. 1, spare top-gallant-mast; 2 and 3, part of lower stadding-sail boom; 4 and 5, the tiller—two pieces of oak plank, three inches thick, one each side of the above spars; 6, a piece of timber to fit in the outer extremity of 4 and 5;* 7, 8, 9, and 10, pieces of chain, say spare mizen-topsail sheets, passed twice round the rudder-post, No. 1, and on which the rudder traverses; 11, 12, and 13, parts of a hawser; 14, part of a stream cable, taken in at the hawse-hole, and secured to the windlass; 15 and 16, double falls to the ropes, 18 and 19, extending from the outer extremity of 4, 5, and 6 (the lever, or tiller), to blocks on the ends of 17, a spare topsail yard, and from thence they are led to the wheel as in ordinary cases.

* Owing to an oversight of our draughtsman, the marks of distinction between these different pieces have been omitted in the engravings; which are in other respects also not exactly conformable to the originals. By attending, however, to the description, we think, nautical men can be at no loss to understand the nature of the construction here pointed out.—ED.

OF THE ANCIENTS—THEIR ARCHITECTURE, SCULPTURE, PAINTING, MUSIC, AND SHIPS, AND THE DISCOVERY OF AMERICA.

Sir,—I saw a notice in your Magazine (No. 247), warning me that you had a *rod in pickle* for me, and that you only waited till I should give you the signal to produce it, by finishing my article on the Ancients. Were I afraid of your rod, I would defer finishing the subject so long, that you might be tired waiting for it; and so I might escape the threatened infliction. I shall, however, as soon as the length of *the subject* will permit, finish it; but I fear that it will be some weeks yet before I can come to a conclusion.

Leaving apologies, I come at once to the subject; and I shall first say a few words on the architecture of the ancients, as compared with that of the moderns. I need not enlarge on this branch, as it is one on which no one holds two opinions. Has any thing been added to the science for these two thousand years? Has a new order been discovered (except Mr. Nash's *positive order*, for which see Langham Church and the New Palace)? or have new and elegant combinations of those in use among the ancients been introduced among us? I think even the most bigoted advocate of the superiority of the moderns will not venture to answer —*Yes.* I do not wish to be supposed to speak of the pyramids and temples of Egypt, though they are grand and magnificent works; but only of those of the Greeks and Romans. The Egyptian works are extraordinary for the labour and ingenuity lavished on them; but they were constructed only in the infancy of the science. I speak not of the ruins of Balbec, and Palmyra, and Persepolis, and the yet wondrous ruins of Babylon, which, even in their present mutilated and ruinous state, excite the wonder and admiration of the spectator; but I refer to the buildings in Athens, in the once magnificent and luxurious Corinth, and in Rome, the Queen of the World. Where do we find in modern times buildings which we can compare with the ruins of these, and say, "Hide your diminished heads, O ancients, for we have surpassed you?" Have we yet excelled the Parthenon, or even equalled it? Will we compare our triumphal gate at Hyde Park with those remaining in Rome? Can we say that St. Peter's, or St. Paul's, or any other Saint's church, is superior to many of the ancient temples? What theatre can we compare with the Coliseum? Is Buckingham House, or St. James's Palace, or Windsor Castle, equal to the Golden House of Nero? But I am labouring in vain, in attempting to prove that which needs no demonstration.

Let us turn to sculpture. It may be enough to remark, that any sculptor of modern times would be proud indeed, if he could look on his work, and say, "This equals any specimen of antiquity now remaining." Yet this even Canova would never have ventured to say. The Venus de Medicis, the Apollo Belvidere, the Laocoon, and some others, have never found modern sculptors to equal them,—far less to surpass them. And yet we have none of the statues which were most celebrated in antiquity. If those, then, which we have, be as yet inimitable, what must the master pieces of Praxiteles and Phidias have been?

In painting we possess but few reliques; yet these few are sufficient to give us a very high idea of the perfection to which the art was brought. Those specimens which we have, are chiefly dug out of the ruins of Pompeii and Herculaneum, —both but small towns; and some from the walls of ancient villas and tombs; yet some of these, though not celebrated at the time when they were painted, would do honour to any modern master: they are finely coloured, the outline and drawing are well executed, and the finishing is bold and skilful. We are, therefore, entitled from this to assert the equality of the ancients in this branch; and this the more, when we read the accounts which are given of the paintings of Apelles, and Zeuxis, and others, and when

we consider their excellence in the sister art of sculpture.

In music, although there are several Treatises on the subject yet remaining, we know not enough of the state of the science to be able to draw a very satisfactory conclusion as to the *resemblance* between ancient and modern music. *We know* that it had been cultivated with the utmost assiduity during a space of a thousand years; and from this we may infer, that so ingenious a people as the Greeks, and so passionately fond of music, must have advanced at least as far as we, who cannot, with propriety, be said to have cultivated the science for more than three hundred years. *We know* that they were well skilled in all the theory of music; that they were acquainted with the scales as perfectly as we; nay, that they even divided, *in practice*, the notes into *quarter tones*, while we never do into more than half, or semi-tones; that they were accustomed to have concerts of all instruments, and to accompany their voices by musical instruments; in short, though we can form no very adequate idea of *what kind* their music was, we must allow that the descriptions given of it by their writers would most perfectly answer for our music, and that their knowledge of the theory was quite equal to our own; we may therefore conclude, that in this branch they are not inferior to the moderns. Alexander the Great was so moved by the martial tones of the lyre of Timotheus, that he rose in an ecstasy of fury, and drawing his sword, plunged it into the breast of one of his friends. Timotheus changed to a mournful measure, and immediately melted Alexander into the profoundest grief for the rash action which he had committed. Orpheus could, by the sound of his lyre, draw the woods and rocks after him, and even drew tears down Pluto's iron cheeks. Different cities were said to have been built by the sound of the lyre, making the stones arrange themselves in proper order. Mercury and Apollo are said to have softened and refined the rugged nature of the first men by the powers of their music. Arion even melted the heart of a dolphin, so that it conveyed him safely to shore on its back, when he had been treacherously thrown into the sea; thus using him better than the shark did Jonah. All fables, it is true (the first excepted); yet sufficient to show the extraordinary influence which was popularly ascribed to music in ancient times.

Having thus gone over the pretensions of the ancients, as to their writings, their music, poetry, painting, and architecture, and shown that in none of these were they inferior to the moderns, though in some of them much superior, I proceed to consider the useful arts; and first, of ships.

Here the superiority of the moderns is undoubted; yet I am prepared to establish that no sufficient justice is done to the ancients on this subject. They had the great disadvantage of not being acquainted with the mariner's compass; which consequently confined their voyages, *in general*, within sight of land. I say *in general*, because, as I intend to demonstrate, they did frequently *sail far enough out of sight of land*.

Their usual merchant ships were, like ours, propelled by sails, and also oars, like the sweeps which are in occasional use by pirates and others. Cicero (Epist. ad Fam. 12, 15) makes mention of a fleet of merchant ships, the smallest of which was more than 56 tons. This was but a small ship, it is true; but if this were the smallest (which he expressly says) in a fleet of two hundred, what size are we to assign to the largest ships in the same fleet? Ptolemy built a ship of 420 feet in length, and another of 300; the tonnage of the larger being 7200, and of the smaller, 3200! What shall we say of the size of these? The ship which brought the great obelisk from Egypt, in the time of Caligula, had, besides the obelisk itself, no less than 1140 tons of lentils *for ballast only*. What was the great Columbus, in comparison of these ships? Let these instances suffice to prove that the ancients were not so ignorant as is generally supposed of

the art of ship-building. Their long ships, or ships of war, were built for quickness of sailing; and as they were never required to leave the Mediterranean, and were accompanied on all occasions by fleets of transports, storeships, &c. they did not require to be such floating castles as those of our navy. They were impelled by sails and oars; and as they always had at least *three banks of oars, one above another*, they must have been of considerable size. We even hear of *eight and ten banks of oars.* Even in the time of the Trojan war, which took place nearly one thousand years before the birth of Christ, their ships of war must have been of very considerable size; for the smallest mentioned (those of Philoctetes), contained 50 soldiers, with all their stores; and the ships of Agamemnon contained 120 men, with their stores, arms, &c. So much may serve for giving some idea of the size of the vessels of the ancients. We turn now to the voyages they were in the habit of making. And here I may remark, that they (I speak of the Romans) never required to sail to such distances as we do now, as almost the whole of the world known in their time might be got at from the coasts of the Mediterranean. They knew little—almost nothing, I might say—of Asia beyond the Indus; consequently could get at what part they knew, much better by land than by sea. As to Africa, they were acquainted with the most of it inland from the coasts of the Mediterranean (indeed, much better than we now-a-days); and could, of course, reach it better from the Mediterranean than by sailing round it. Yet even this they did; as Herodotus informs us that it had been done even before his time; and Pliny, one of the most accurate writers whom one can name, mentions (C. 22) "that Spanish ships were wrecked in the Red Sea;" consequently they must have sailed round Africa. He also mentions that "some Indians sailing from India on a trading voyage, were, by the force of the wind, landed in Germany." These, also, must have sailed *intentionally* round the Cape of Good Hope, and even much farther, before they could have landed in Germany. Ships, also, in the time of Solomon were in the habit of making voyages of three years' duration, to Ophir. This could not but have been a very distant voyage; though I do not, as some, affirm, nor attempt to prove, that it was to America. I proceed, however, now to prove that *the Phœnicians, and perhaps the Atlantii, were acquainted with the continent of America,* though the knowledge of it was afterwards lost.

The Atlantii settled in Mauritania (now Morocco), and were so named from their king, Atlas, a great astronomer, and brother of Saturn, or *Time;* being thus one of the most ancient people of whom history makes any mention. These Atlantii gave the name to the Atlantic Ocean, which it yet retains. Plutarch makes mention of "seven islands in the Atlantic, beyond the country of Atlas (Morocco), distant 10,000 stadia." These were the Fortunate Islands, or Canaries; and "*beyond these was the country of Tritonia,*" where, he says, "the Atlantii reigned." I am at a loss to conceive what country but America this could by any possibility have been. It is probable, then, that the descendants of Atlas were acquainted with America.

The Phœnicians were the greatest merchants of antiquity, and sometimes were reputed to have been the inventors of sailing, &c. They were in the habit of making very long voyages, even out of sight of land; in which case they sailed by the guidance of the stars; and there is good reason to believe that they were in the habit, *for years*, of sailing to America. How otherwise are we to explain Plato's Atlantic Island, of which he gives so particular an account, "*situated many days' sail beyond the pillars of Hercules*" (the Straits of Gibraltar)? But granting this to be but a fiction of his own, and not a true account, learned, as he *so solemnly* affirms, from the Egyptian priests, the great depositaries of all the knowledge of those times, we have yet many other authorities, which give every degree

of probability—I might say, which prove beyond a *reasonable* doubt—that the Phœnicians were well acquainted with America, and were in the habit of trading to it. Clemens Alexandrinus says that "other lands were known to the ancients beyond the ocean." Whence came this tradition, unless from the knowledge of America? Ælian, in the third book of his History, says that "Europe, Asia, and Libya, or Africa, were surrounded by the ocean, but that beyond them *was a certain continent of an immense size;* that in it were great cities, and customs, and laws, different from those in the old world." He says, that "in this land was a great plenty both of gold and silver, so that it was of as little value to the natives as iron to Europeans." Whence came *this* tradition? and how exactly does it resemble the account we might expect to hear from a person who was but half informed on the subject on which he wrote. Marcellinus says, that "*in the Atlantic Ocean was an island larger than Europe.*" Seneca the tragedian says, "That there are fertile lands in the ocean (meaning Europe, Asia, and Africa), and that beyond it (the ocean) was *another world.*" Again, he says, as if predicting the discovery of America by Columbus, "There will come a time, in future ages, when the immense ocean will relax his boundaries, and the mighty earth will lie open before us; and Typhis (Columbus?) shall discover a new world, and no longer shall Thule (Iceland) be accounted the end of the earth."

Diodorus tells us, "That in very ancient times the Phœnicians, sailing beyond the pillars of Hercules (the Straits of Gibraltar), had been carried by long-continued storms of wind to far distant tracts of the *ocean* (the *Atlantic*, which was always so named), and after being tossed about for very many days by the violence of the tempest, had at last come to *an immense island in the Atlantic Ocean, distant from Libya (Africa) a sail of very many days towards the* WEST. Its soil was fruitful, its rivers navigable, its buildings sumptuous. From this the Carthaginians and Tyrians received the knowledge of these lands." He adds, "When afterwards the Athenians were often oppressed in war by the Tyrians and Moors, having sailed past Gades (Gibraltar), and into the Atlantic Ocean, they at last arrived in these new regions, and planted a colony; and had long kept this a secret, that if they were again expelled from their native country, they might have a country to which to retire." There is some change in the story, as related by others, "that the Carthaginians had by chance found this country, and that very many, contrary to the commands of the magistrates, had removed to it; and that at last, from the number of people who went, it was made a capital crime; so that gradually the knowledge of it died away." Need I produce more testimonies to prove that America was known to the ancients, and that they were in *the habit* of sailing to it? If they knew it not, how comes it that they so exactly described its situation? They must have been the best guessers of whom we have any account or idea. How was it that they described it to be of such an immense size,—as large as Europe and Africa?—that the rivers were so large?—that gold and silver were in such abundance?—and that the soil was fruitful, and their laws and customs different from ours? Had they affirmed all this on pure invention—which seems to be impossible—they would not have been content with so moderate a description, but have painted them like "the Anthropophagi, and men whose heads do grow beneath their arms." But, on the contrary, they narrate nothing absurd. Let not the reader be startled, when he reads that "the buildings were sumptuous." This might well have been so, when we consider that of Babylon and Nineveh, those two great cities, we can do little more than guess at the place where they stood, and *that* in such a climate as that of Mesopotamia. We may well, then, suppose that in such a climate as that of America, all vestiges have disappeared of their former greatness; yet in Mexico have been found remnants of splendid temples, tombs

cut in the rocks like those of Egypt, containing mummies, and even *hieroglyphics* cut in the rocks, &c. The remnants of these, indeed, have been traced from Lake Erie, all across the continent, to the shores of the Pacific. The Mexican records do not extend farther back than to the year 600. Yet we find, that even before that time they must have been a powerful race, from the accounts then given of themselves; and we find that, after that time, many changes and revolutions took place among them, so as easily to account for their having lost most of the arts which they had learned from their ancestors. But even if I have failed in proving that the Phœnicians did know America, yet it must be allowed that I have established that they were in the habit of taking long voyages; else the authors, who relate these things, would undoubtedly have expressed their disbelief of them, and given as a reason, that they could not have made so long voyages; but we find nothing of the kind hinted at by them. The ancients, then, *did* make long voyages—longer than any undertaken by the moderns, till A. D. 1490; and are we, then, entitled, *simply from want of sufficient information* on the subject, to conclude that the ancients knew nothing, comparatively speaking, of navigation? *We have seen* that they knew how to build ships, to which the most enormous ships of modern times cannot be compared in size, and even *how to make useful the largest of these ships;* we have seen that their common ships were not nearly so small as they are usually supposed to have been, and that though in their ships of war they did not make long voyages, yet that, on mercantile expeditions, they could double the Cape of Good Hope (not discovered by moderns till the year 1482!) and even reach America. And can we, seeing these facts, and knowing that we have in ancient writers *but very few hints even* from which we may form an idea of the state of their navy, *calmly sneer at the puny cockle shells* (as some have *wittily* called them) which the ancients called ships? How often have we found writers, who boast that one man of war of modern days would defeat a whole fleet of the time of Augustus? This advantage, however, comes *only from the use of gunpowder* (and I intend to show that even gunpowder was known to the ancients, and applied, as by us, to throwing shot); but even with the advantages of gunpowder the fight might be doubtful, when we consider that we have lost the use of the Greek fire, which would burn under water, and with which they could have set our ships on fire.

In my next, I shall proceed to examine the knowledge of the ancients on other points. For the present, I must conclude with begging your pardon for the length to which I have gone, and with hoping that you will excuse the many imperfections of this paper, since it has been all put together within a few hours. I also beg to mention that I am responsible for the correctness of the quotations and translations which I introduce.

I am, Sir,
Yours, &c.
FRANCOIS DUBOIS.

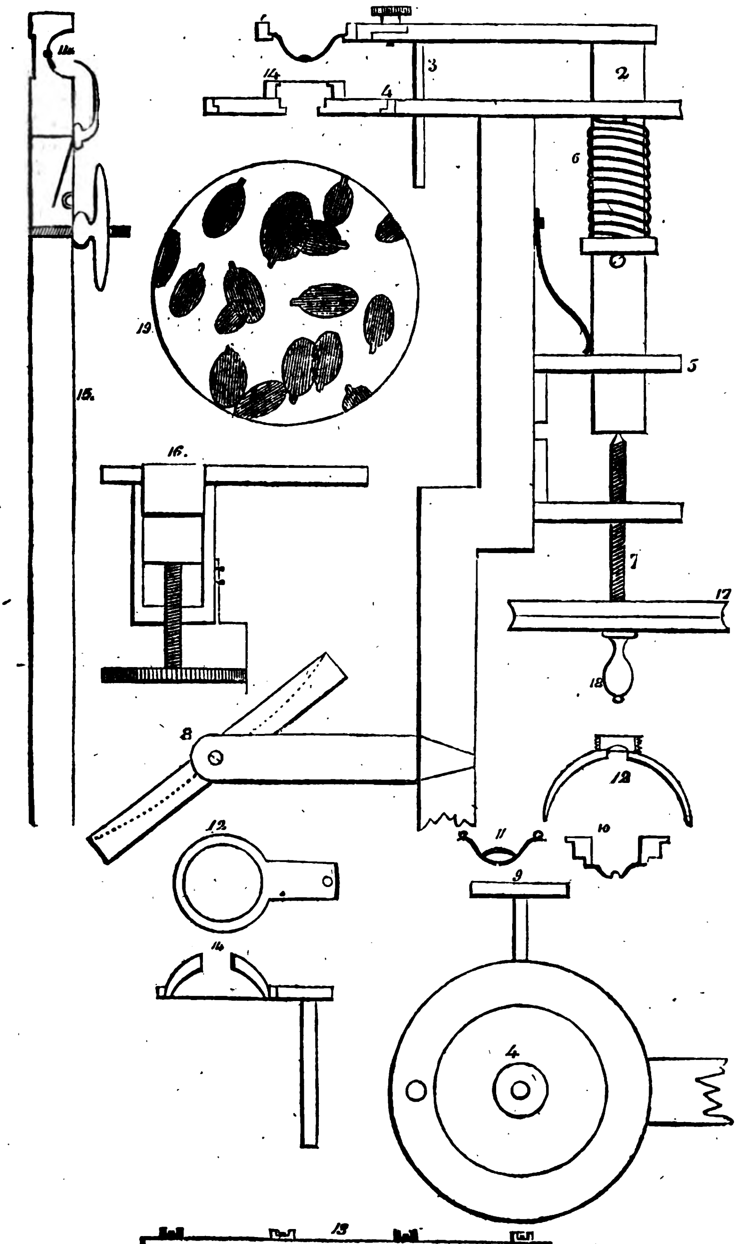
Monday, May 12, 1828.

ON THE CONSTRUCTION AND USE OF MICROSCOPES.

(Concluded from page 283.)

There should be six good powers selected, say 1-90th, 1-50th, 1-30th, 1-16th, 1-8th, 1-4th inch focus, and fitted up with eye-pieces, or buttons, about half an inch diameter, made of ivory, dyed black. The arm of the microscope should have a simple ring fixed to it, half an inch in diameter (see fig. 1), without a screw, but with a thin rim left at the bottom to catch the edges of half a dozen thin brass cups, with small but different sized holes in them, to try the lenses. To this arm should be fixed a piece of brass wire (2), quite straight as it comes from the drawer, and also a piece of small steel wire (3). These wires should pass through the stage (4), and the

brass wire through the piece (5). It should just fall down by its own weight, without any lateral motion whatever. This is the only part that requires nicety; but any watch-maker can do it easily. It is pressed



downwards by the spring (6), and upwards by the fine screw (7), with a large milled head. The mirror is represented by fig. 8; 9 is a piece to lay the slides upon; 10 an eye-piece; 11 the two brass cups and wire ring that holds the lens in the eye-piece; 12 a ring, with a female screw to fix the opaque eye-pieces to; 13 a strip of glass, with pieces of jet and ivory glued on to fix opaque objects on; 14 an ivory ring, with a piece of talc glued on the top. A smaller piece, and a wire to hold the test objects between, is pressed to the top.

The best test objects for proving and comparing lenses are the scales of the *lepisarca sacharina* (19), the beautiful lines of which I have been unable to discern through some compound microscopes. It is an insect found in the damp parts of houses, and often among old books; it runs very fast, and shines like a fish. If the silver speculum for opaque objects is fitted to an arm (16) passing through the stage, it will do for several of the low powers. An easy way of fitting up a globule microscope is represented in 15. It consists merely of two strips of brass, rivetted together at one end, and two holes made in the other; to one is soldered a thin brass cup, and to the other is glued a piece of talc, at the back of which the objects are stuck. The globule may be kept in its place by a spring, or by any other means. The lens is brought to the object by a small screw. The wood cutter (16) is merely a tube soldered to a flat plate of brass: at the bottom of the tube is a fine screw, with a large coarsely milled head; at the side is fixed a wire click spring, so that, by telling the clicks, shavings of any degree of fineness may be cut, even in the dark, by sliding a sharp razor over the plate. There should be a piece of wire the size of the tube put in before the wood, to prevent the screw from cutting it.

Among the best tests for lenses are the scales of fish, especially the sole, perch, eel, dace, &c.; the circulation of the blood in the leg of the young spider, the tail of the tadpole, animalculæ in hay and potatoe water, sour paste, &c., farina of flowers, stings and lancets of insects, the crystallization of salts, the precipitation of silver from the nitrate, by copper or jet, mites from cheese, &c. When the eye of the dragon fly is laid in water for a day or two, it separates easily into two membranes; and the outer one forms a particularly fine transparent test object for trying lenses, even of the highest power. But after all, perhaps, a lens of 1-30th of an inch focus will show an object better than a higher power. With this lens all the best test objects are pleasantly seen.

The highest powers of the telescope are only applied to clusters of remote worlds, and those of the microscope to clusters of minute animalculæ. In the former we can but just perceive luminous points in a dark field, and in the latter dark points in a luminous field. How similar in appearance, yet how wide the difference! The silver speculums may be figured and polished in the same manner as the lenses, if the hone is covered with a thin silk for a polisher. To silver the miniscus (or, if that cannot be procured, a convex lens will do); cut a piece of tin foil, a little smaller than the glass, with a tail to it, and a piece of silk paper of the same shape. Now pour a little cement on a board; when nearly cold, press the glass on it to form a cavity; put the foil in; rub a little quicksilver all over it; fix it; lay the paper on the quicksilver, and the clean glass on the paper; press the glass gently, and draw the paper from under it; then press the quicksilver out; cut the tail close to the glass, and set it on the edge. The drop of quicksilver may be removed by touching it with a piece of amalgam.

PERPETUAL MOTION.

Sir,—I have ever understood that the object of those who waste their precious time in pursuit of that nonentity commonly called Perpetual Motion, is uniformly to produce a self-acting machine, which, indepen-

dently of every other agent, shall be capable, when once set in motion, of generating, by a due application of mechanical power, an excess of force sufficient to counteract the effects of friction, and other impediments, and also capable of returning on itself an impulse equivalent to that which it originally received.

If this be the end that perpetual motion projectors have in view, then Mr. Bull (No. 242 of your valuable publication) might have spared himself the trouble of announcing to the world, that by the application of two distinct agents a perpetual motion might be produced. Following the idea which Mr. B. has suggested, it would not be difficult to produce a perpetual motion (depending upon an *if* or a *but*) in twenty different ways. For example,—a wheel driven by a constant stream of water (and every stream would be constant if it never failed), would be a perpetual motion. Again; a steam-engine would continue to go for ever (supposing it not to wear out in that time), provided the agents on which its motion would depend, namely, fire and water, were constant in the application of their respective powers; so also would Mr. B.'s clock continue to go perpetually, if his windmill never failed. Still, it could not with more propriety be called a perpetual motion, than the water-wheel or steam-engine above mentioned, even if the wind could be depended upon; which, from several causes, might be considered all but certain. However, a failure is possible; and if this were not the case, it would not be a self-moving independent machine. I shall forbear to comment on Mr. B.'s second plan of producing perpetual motion, because, if it could be made to act (and there is no room to doubt it), it would be, as in the former case, nothing more than a simple machine, driven, as other machines are, by means of the appropriation of some external power; consequently, I conceive that the comprehensive character of "Perpetual" would be incongruously associated with the action of any machine, whose movements depended on the variable circumstances of borrowed force.

I am, Sir,
Yours, &c.
K. G.

Chalford Hill.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(Continued from p. 278.)

We now proceed to give some examples of the theorem which we obtained in our last; namely, that "the ratio of the fluxions of two quantities is the limiting ratio of their increments."

Example 1. To apply this to an algebraic expression, as $a x^2$, let us put $y = a x^2$, then give x an increment h, and let y become y_1 in consequence.

Then $y_1 = a.\overline{x+h}^2 = ax^2 + 2axh + ah^2$
But $y \qquad\qquad = ax^2$.

Hence, $y_1 - y$, (which is the increment of y) $= 2\,a\,x\,h + a\,h^2$, and $\frac{y_1 - y}{h}$, the ratio of the increments $= 2\,a\,x + a\,h$.

Now, diminishing h continually, we see that $2\,a\,r$ is the limit of $\frac{y_1 - y}{h}$.

But we just proved that the ratio of the fluxions, or $\frac{\dot{y}}{\dot{x}}$, is the limit of $\frac{y_1 - y}{h}$.

Hence, $\frac{\dot{y}}{\dot{x}}$ and $2\,a\,x$ being limits of the same variable, are equal.

Or, $\frac{\dot{y}}{\dot{x}} = 2\,a\,x, \therefore \dot{y} = 2\,a\,x.\dot{x}$, when $y = a\,x^2$.

Example 2. In a similar manner we shall find the fluxion of $a\,x^3$ to be $3\,a\,x^2.\,\dot{x}$.

Example 3. Now, put $y = a\,\overline{x}^{\frac{3}{2}}$

Then the fluxion of $y^2 = 2\,y.\,\dot{y}$, and of $a^2\,x^3 = 3\,a^2.\,x^2.\,y$

$\therefore \overline{y^2 = a\,x)}^3 = a^3 . x^3$

$\therefore 2y . y^{\cdot} = 3 a^3 . x^2 . x^{\cdot}$

$\therefore y^{\cdot} = \frac{3}{2} . \frac{a^3 . x^2 . x^{\cdot}}{y} = \frac{3 . a^3 x^2 . x^{\cdot}}{2 . a^{\frac{3}{2}} . x^{\frac{3}{2}}}$

or the fluxion of $\overline{a x)}^{\frac{3}{2}} = \frac{3}{2} . a^{\frac{3}{2}} . x^{\frac{1}{2}} . x^{\cdot}$.

To find the fluxion of a number of quantities, as $A\,x \pm B . x^2 \pm C x^3 +$, &c. we must take the sum of the fluxions of the terms.

Thus, putting $y = A\,x \pm B\,x^2 \pm C x^3$, and giving x an increment, h, as before, we have

$y_1 = A . x + A\,h + B . \overline{x + h)}^2 + . C \overline{x + h)}^3$
$= A . x + A\,h + B . x^2 + 2 . B\,x\,h + B h^2 + C . x^3 + 3 . C x^2\,h + 3 C\,x\,h^2 + C . h^3$

Collecting the terms, we have

$y_1 = (A\,x + B\,x^2 + C\,x^3) + A\,h + 2 . B . x\,h + 3 . C\,x^2 h + B\,h^2 + 3 . C\,x\,h^2 + C\,h^3$.

Now, $A\,x \pm B\,x^2 + C\,x^3 = y$.

Hence, $y_1 - y = A\,h + 2 . B\,x \pm 3 C\,x^2 + B . h^2 + 3 C\,x\,h^2 \pm C\,h^3 . \therefore$

$\frac{y_1 - y}{h} = A \pm 2 . B . x + 3 . C\,x^2 + B . h + 3 C\,x\,h + C\,h^2$; the limit of which we find, by diminishing h, to be $A \pm 2 . B\,x + 3\,C\,x^2$.

Hence, the ratio of the fluxions of y and x being equal to this limit, we have

$\frac{y^{\cdot}}{x^{\cdot}} = A + 2 . B\,x \pm 3\,C x^2 x^{\cdot}$, and $y^{\cdot} = H\,x^{\cdot} + 2 . B . x^{\cdot} + 2 . B . x . \dot{x}$.

Example 5. This will assist us in finding the fluxion of such a quantity as $\sqrt{2\,r\,x - x^2}$.

Put $y = \sqrt{2\,r\,x - x^2}$;

then $y^2 = 2\,r\,x - x^2$.

But the fluxion of $y^2 = 2\,y . y^{\cdot}$, and the fluxion of

$(2\,r\,x - x^2) = 2\,r . x^{\cdot} - 2\,x . x^{\cdot}$
$= 2\,(r - x) . x^{\cdot}$

$\therefore 2\,y . y^{\cdot} = 2 . r - x . x^{\cdot}$

$\therefore y^{\cdot} = \frac{r - x . x^{\cdot}}{y} = \frac{r - x}{\sqrt{2\,r\,x - x^2}} . x^{\cdot}$.

27. Putting these fluxions into the form of a Table, we have

Table I.

the fluxion of $a\,x^2 = 2\,a\,x . x^{\cdot}$
$a\,x^3 = 3\,a\,x^2 . x^{\cdot}$
$a\,x^{\frac{3}{2}} = \frac{3}{2} . a\,x^{\frac{1}{2}} . x^{\cdot}$
$A\,x \pm B\,x^2 + C\,x^3 = (A \pm 2\,B\,x \pm 3\,C\,x^2) . x^{\cdot}$
$\sqrt{2\,r\,x - x^2} = \frac{r - x . x^{\cdot}}{\sqrt{2\,r\,x - x^2}}$.

28. The quantities on the left side of this Table are called the fluents of the corresponding quantities on the right.

Thus, $a\,x^2$ is the fluent of $2\,a\,x . x^{\cdot}$, or, as it is commonly expressed, $a\,x^2 = \int 2\,a\,x . x^{\cdot}$.

29. Since the fluxion of x is only the velocity with which it increases, a quantity $a\,x$, which is (a) times greater than x, will increase with a proportional velocity, or the fluxion of $a\,x$ will be (a) times greater than $x^{\cdot}$, and $= a\,x^{\cdot}$

Hence, the fluent of $a\,x^{\cdot}$ will be (a) times greater than the fluent of $x^{\cdot}$, or $\int a\,x^{\cdot} = a \int x^{\cdot}$; by which it appears that it matters not on which side of the sign $\int$ the constant multiplier is placed.

Hence, it is evident that we may multiply or divide the expression within the sign $\int$, by any constant we please, without altering the value, provided we place an equal divisor or multiplier on the other side of the sign.

30. Bearing this in mind, we may easily obtain from our last Table the one which follows:—

Table II.

$\int 2 . \sqrt{a\,x . x^{\cdot}} = \frac{4}{5} . \sqrt{a}(x)^{\frac{3}{2}} = \frac{4}{5} . \sqrt{a\,x}\,x$.
$\int 4\,c\,a\,x . x^{\cdot} = 2 . c\,a\,x^2$
$\int (2\,c\,r\,x - c\,x^2) . x^{\cdot} = c\,r\,x^2 - \frac{3}{3}$
$\int 2\,c\,r\,x^{\cdot} \qquad = c\,r\,x$.

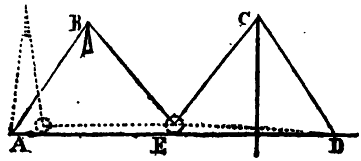
(*To be continued.*)

PLAN FOR DISPENSING WITH PADDLES IN PROPELLING STEAM VESSELS.

Sir,—As many efforts have been made to perfect the machinery by which steam-boats are propelled, and this object does not seem yet to have been accomplished, I would request permission, through the medium of your pages, to suggest to persons engaged in these pursuits some ideas upon the subject, which they

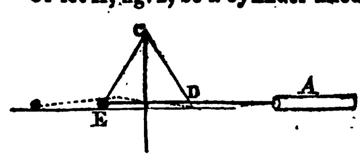
will probably find partly, if not wholly, new. That paddle wheels are imperfect instruments in the propulsion of vessels, and that great inconvenienee attends the use of them is well known, and various attempts have been made to remedy their defects; but I am not aware that any improvement has been made, so great or so obvious as to come into general use. The very principle of employing the water as a fulcrum in the use of paddles of any description whatever, seems to me necessarily to occasion a loss of half the power expended; for the power of the engines is expended as much in giving motion to the water, as in giving motion to the vessel. This I think will always be the case, when a fulcrum is employed which is as moveable as the body intended to be propelled. Every float of the wheel raises a certain quantity of water above its proper level; and did we possess any means of applying to our use the power of that water as it sinks to its level again, that half of the power which is now wasted, would be regained and saved. I propose to show that paddle wheels may be dispensed with, that the whole of the machinery may be placed within the vessel, and that we may employ a fulcrum which will return the power expended upon it. These advantages have probably been deemed impossible to be obtained, but I think I can demonstrate the possibility of obtaining them. Why it appears impossible is, that in the machines which we have observed in action in vessels (the human body, for instance, as the most common), if one part has pressed the vessel forwards, another part of the machine has occasioned an equal pressure backwards, and therefore the vessel moved not till some external substance was used as a fulcrum, and so occasioned an unequal pressure. If a machine can be constructed so as to occasion an unequal pressure, and to press more forwards than backwards, the vessel containing that machine, will be propelled by it, whether the fulcrum be within or without the vessel.

Let A B C D be four levers, con-



nected by hinges, the end of the lever D being towards the forepart of the vessel. The hinge connecting the two middle levers B and C, not being fixed, and having a small wheel, so as to run freely upon the plane surface E. Suppose a certain weight attached to the joint B, and the joint C to be connected with the piston-rod of the steam-engine, and that the piston was forced down till the levers assumed the form represented by the dotted lines. Now, the pressure of the weight B would be communicated to A, and the vessel by it would receive a pressure backwards; which call a pressure of 5. But to overcome this pressure must require a greater power; the power, therefore, applied to C, suppose equal to 10; then the pressure towards D would be 10: which it is very evident would be communicated no farther than the point B. Here, then, there is a surplus pressure of 5 towards the front of the vessel. And now, as part of the power has been expended in giving motion to the fulcrum, or raising the weight B, that weight, as it sinks to its place again, may be made use of in giving another stroke with another set of levers, and so on. Thus the vessel at every stroke receiving a greater pressure forwards than backwards, must be driven forwards.

Or let A, fig. 2, be a cylinder fixed



in the vessel, having a piston within it, which is connected, by means of the piston-rod D, with the little wheel E fixed at the end of the levers

E C D, which are somewhat similar to those before referred to, being connected by hinges, and C D being also joined to the vessel at D. Let, also, the piston-rod of the engine be connected with C, and depressed till the levers assume the form represented by the dotted lines; thus drawing forward the piston within the cylinder A, and causing a vacuum in it.

Allowing, therefore, the pressure of the air upon the piston of A to be 5, then the pressure of the air upon the end of the cylinder A will be 5, which will be backwards. But to move this piston as proposed will require a greater power,—suppose 10. Here, then, the pressure towards D, or forward, is 10, while the backward pressure is only 5; and the vessel would be propelled by the force 5. As by means of the levers E C D the power of the engine is exerted equally in opposite directions, it tends just as much to press the cylinder and the vessel containing it away from the piston, as it does to press the piston away from the bottom of the cylinder. And here again, as there is a vacuum formed, the atmospheric pressure may be made use of in returning the power expended in forming it, by having another cylinder, and levers similar to these.

I think I have now proved that vessels might be propelled by internal machinery alone, and that that power which is now wasted might be saved. I have not, however, represented those forms of machinery which I think would be most suitable in the application, but only such as were most convenient for demonstrating the principle. Should any of your readers be disposed to reduce it to practice, and wish to know what I think the best method of applying this principle, I will, with your leave, lay it before them; and if the principle is not correct, I should be glad to see the error pointed out. If it is, there may be, perhaps, another advantage derivable from it. A ship which had lost its rudder at sea might be steered by such a machine within it; and the same principle might be applied to any thing designed to be propelled by internal machinery.

I remain,
Yours, &c.
Harlow. J. BARNARD.

NEW PUBLICATIONS

Connected with the Arts and Sciences.

The School of Architecture and Engineering. Illustrated by numerous Copper-plate Engravings, Drawings on Wood, &c. By PETER NICHOLSON. Parts 1, 2, and 3, price 1*s.* 6*d.* each. 1828.

Mr. Nicholson has already contributed so much, by his different publications, to the improvement of the various arts connected with building (more, perhaps, than any other writer of this country, either ancient or modern), that on seeing a new production from his pen announced under the above title, we could not but wonder whence the new matter of which it was to consist could be derived. On perusing, however, Mr. Nicholson's "Introduction" to this "School of Architecture and Engineering," we found a very sufficient case of expediency, if not of necessity, made out for its appearance. Mr. N. states, that all his former works "were limited to the use of certain departments of the Building Art, but principally to Carpentry; and, therefore, it has occurred to the author, that a treatise, containing more general information, would be a valuable acquisition; particularly as it is his intention to introduce no subjects except with improvements; or such as shall either be new in principle, or new in respect of example."

The work is to be completed in fourteen Parts, and "as the plates are nearly all engraved, and the printing in a forward state," intending subscribers are assured that it will be "completed during the present year, 1828."

Article I. Part I. is addressed to "Architectural Draughtsmen and Stone Cutters;" and contains a full description of the mode of projecting the joint lines of the masonry of a niche in a hemispheric dome, illustrated by an extremely neat and accurate copper-plate engraving.

Article II. which is devoted to "Master Carpenters and Joiners," comprehends "An *entirely new* Method of Squaring Hand-rails." "Though several eminent staircase hands are in the habit of squaring hand-rails, by cutting the plank,

from one of its faces, perpendicularly through its thickness; yet they have *no rules* for bringing it to the required form, but by bending a pliable substance round the ends of the steps upon the nosings; and then, by certain marks upon the top and sides of the body thus impressed, which is supposed to retain its figure after being removed, they are enabled *to guess* at the position in which they may cut the piece intended to be squared out of the plank, and to form it, in some measure, to the required figure, *by eye.* The following method is *correct*, and may be depended upon; the workman may proceed in the execution without hazard, and, as the principle is simple, it will be easy for him to practise; likewise, since there is a considerable saving of stuff, particularly in length, it will be advantageous to the master; and therefore, it is hoped, will be acceptable to both." The method here described is *not* that for which, as most of our readers of the class of builders and carpenters are aware, Mr. Nicholson obtained a gold medal from the Society of Arts some years ago, and which has already come into general use; but an "entirely new" and different one, founded on a more scientific principle, and, on this account (as is always the case where practice is enlightened by science), a great deal more economical. Mr. N. admits at the same time, that in most cases, the method which he first recommended may be employed with *more facility* than the present; and that, in the case of wide openings, the waste attending it is not of so much consequence. He has, therefore, in a subsequent Article (Art. IV.), added an account of that method, and taken occasion to introduce a very material improvement as to the manner of applying the *face* mould to the plank. Many persons, who have perused the former account furnished by Mr. N. to the Society of Arts, must, we dare say, have a lively recollection of the difficulty they experienced in comprehending it; and some, were they to confess the truth, would own that they have read and studied it often to no purpose. Mr. N. now candidly acknowledges that it was a very obscure description, and "has unfortunately been understood only by the sagacious and experienced workman, who, by attentive perusal, discovered *at last* the meaning of the author." We presume, that either the plan has become more familiar to the author's own mind, by frequent reflection upon it, or that he has acquired greater skill in the developement of his ideas; for certain it is, that no objection can be taken, on the ground of obscurity, to the description before us, which is as clear and intelligible as the youngest joiner need wish. The art of constructing hand-rails is at present confined to a few hands; but now that Mr. N. has so simplified it, by the explanations and improvements contained in the present work, we shall expect to see it become as generally known and practised as any of the commonest branches of the building art.

Art. III. (which we had passed over, to notice the additional method of constructing hand-rails, described in Art. IV.) gives an account of "the Masonic Principle of constructing Geometrical stairs, Landings, and Galleries;" it is plain and practical, suited to the comprehension, as well of gentlemen engaged in building as of designers and workmen themselves.

Art. V. Part II. "On the Lengths of Circular and Elliptic Arches," is one of extraordinary merit and most extensive utility. In the execution of bridges, and of extensive arches in buildings, it is often required to ascertain the length of the curve, or its extension in a straight line, in order to measure the surface of the intrados; but wherever the curved surface is of considerable magnitude, or the scaffolding is no longer standing, this can only be done by the laborious process of computing, from the height and span of the arch, the length of the curve according to its species. To save architects and engineers this trouble, Mr. N. has here given two Tables, by a reference to which the lengths of circular and semi-elliptic arcs may be ascertained at a glance—sufficiently near the truth, at least, in all cases, and with the most scrupulous degree of accuracy in such as correspond to the numbers in the Tables.

Table I. contains no less than four hundred proportions of circular arcs upon equal bases, rising in arithmetical progression from 100, and increasing in height by a unit at a time, until the last curve rises 500 parts of the base, or, in other words, becomes a semicircle. In Table II. of semi-elliptic arcs, the heights increase by a unit at a time from 100 to 1000, in order that a person consulting it may the more readily obtain the lengths of surmounted as well as surbased curves. On the great practical convenience of these Tables it would be superfluous to enlarge; it is such, that we are convinced no architect or engineer will now think of carrying on an extensive practice without them.

Art. VI., which occupies the rest of No. II. and the whole of No. III., is devoted to the subject of "Orthographical Projection."

"It may be asked," says Mr. N. "what is the difference between Projection and Descriptive Geometry?"—"*Projection*," he says, "is an art which teaches the rules for representing or drawing, upon ONE PLANE, any body or solid whatever, of which the dimensions, the position of its faces to one another, and the position of one of them to the plane of projection, are known; whereas *Descriptive Geometry* teaches the methods of representing a body on TWO DIFFERENT PLANES, one perpendicular to the other; and thus every point or line in the body will have two projections—one on the one plane, and the other on the other plane." We must confess, we do not perceive the worth of the distinction which is here made: it seems to us to be, at best, merely a nominal one. A method which teaches the rules for representing objects on *one* plane must be as much a matter of descriptive geometry as one which explains the manner of representing a body on *two* planes; the one method may be better than the other, but there can be no *generic* separation between them. Projection is, in truth, only a superior sort of descriptive geometry, and not something different from it; or, as Mr. Nicholson himself afterwards allows, "projection on one plane, and projection on two planes, make, together, only one complete science." To persons "who wish never to be at a loss to draw all the parts of a design, so as to obtain a clear conception of the intended object, as if it really existed, and to be able to give rules for its actual construction," a knowledge of both methods must be of the greatest consequence; and to such as have yet the superior method to learn, we would recommend a careful study of the treatise which Mr. N. has here furnished. It has been drawn up with great care; and though written in rather an affectedly learned style, will be found, upon the whole, easy enough of comprehension. So practical and sensible a man as Mr. N. should not be so fond of making a parade of definitions (in which he is almost always unfortunate), axioms, lemmas, and scholia. He owns, very ingenuously, that "the difficulty of inventing or improving has always been less with me, than that of describing my inventions or improvements," (p. 27.) We are surprised that he has not, before now, discovered that this difficulty is not in the least diminished, by putting on a scholastic air for the occasion.

From the analysis we have now given of the first three Numbers of the Work, it will be seen that "The School of Architecture and Engineering" promises to be a work, not only of decided utility, but of great originality, and to add, in no small degree, to the scientific reputation which Mr. Nicholson has already so deservedly acquired.

MISCELLANEOUS NOTICES.

Sir William Congreve.—We regret to perceive an announcement in the newspapers, of the death of that ingenious and scientific officer, at Toulouse, on the 16th instant. His name stands connected with a number of inventions, his claims to the origination of which (the Congreve Rocket in particular) have been much questioned; though, probably, as much from envious feelings, as from any just cause. He is allowed on all hands to have possessed, in perfection, what is only second to genius itself,—the art of turning to the best possible account any invention or project of which he was the author or patron; and hence, perhaps, some of the jealousy with which he was regarded by equally clever, though less successful, projectors. We had the honour of ranking him in the list of original contributors to this work. One of his latest communications to which, was the Plan of an Aërial Carriage, published in No. 244.

Fracture of the Skull.—It is a fact, not perhaps generally known, that fracture of the skull,—an event frequently very dangerous,—is nevertheless, occasionally an antidote to compression and concussion. Its salutary effect may be thus exemplified. If a watch fall on its back, the main spring will break from the concussion; but if it fall on its face, the fracture of the glass obviates the concussion, and the spring is saved. It is just thus with the brain.

A Tame Toad.—We know an eccentric and intelligent Irish gentleman, who carried a toad from Scotland across the Irish Channel, to prove to his countrymen, that it would live in Ireland, in spite of the exorcism of St. Patrick. This toad lived with him several years, and grew so tame, that it would come of its own accord to be fed. Its favourite food was earth worms and slugs. During the winter it regularly disappeared, secreting itself, no doubt, in some convenient retreat during its hibernation. When the weather became warm again, in spring, it never failed to appear, and sometimes even returned into the parlour to announce its return.—*Verulam.*

Solution of Copal.—The common process of dissolving copal in spirits of wine, which is extremely tedious, may be rendered at once easy and expeditious by the addition of camphor. You must first dissolve the camphor in the alcohol—one ounce of the former to a quart of the latter; put the solution into a glass, and add eight ounces of copal in small fragments; place the mixture in a sand bath, of such a temperature that the bubbles which rise from the bottom may be counted as they rise, and let it thus remain till the solution is complete. By this process, more copal may be dissolved than the solvent will contain when cold. The most economical plan is, to put the vessel aside for some days; and when the solution is completed, to decant the clear varnish, and leave the residuum to undergo a repetition of the process.

Loss of Brains.—The present Duke of Manchester met with an accident, by which a piece of

his skull was kicked away by a horse, with a portion of the brain also; and yet his Grace has made a very excellent Governor of a colony notwithstanding. It is now well known, that the outer, or, as it is called, the *cortical* part of the brain, is entirely devoid of feeling when in a natural and healthy state; and that any portion of it may be lost by accident (as in this instance), or by disease, without any interference with the intellect of the individual. It is only when the medullary, or innermost portion of the brain, is compressed or injured, that life and intellect are affected.

The Comet of 1826.—From a calculation by Dr. Olbers, it appears that the comet of short period, whose last appearance was on the 27th of Feb. 1826, passed by the earth's orbit at only a little more than twice the greatest distance of the earth from the moon, and that it is possible it may, at some future time, pass at so small a distance, and even so near, that its atmosphere may be in contact with ours!

Black Pepper.—An elementary principle has been recently discovered in black pepper, which has been denominated *piperine*, and found to be a successful remedy in intermittent fevers. It has been employed in doses of one grain every hour, with as much success as quinine; and when combined with an equal portion of quinine, with even more effect than where quinine alone has been used.

Historical Monuments of the Creation.—Bergman, the better to represent the service which the shells embedded in the strata of the earth render to the geologist, by furnishing him with data from which he may estimate the number, magnitude, and duration, of the revolutions which the globe has undergone, describes them, by an expressive though fanciful metaphor, as being *the medals of creation*. That they do actually serve the commemorative office of medals in this respect, is becoming every day more and more apparent.

Ancient Volcanoes.—Professor Daubeny, of Oxford, in his work on Volcanoes, has stated a number of reasons for believing that volcanic agency was the physical instrument employed by the Almighty to destroy the five Cities of the Plain; that the Salt, or Dead Sea, arose either from the subsidence of the plain, or from the damming up of the Jordan (which he supposes formerly flowed into the Mediterranean, or the Red Sea) by a current of lava; and that "the showers of fire and brimstone" were occasioned by the fall of volcanic ejections. Mr. Henderson, the celebrated Missionary traveller, who is of a similar opinion, imagines that Lot's wife, lingering behind her friends, may have been first suffocated, and then encrusted with saline and other volcanic materials.

Vegetable Resuscitation.—A very old mulberry tree was shattered in pieces by a storm of wind in 1790; afterwards, an elder tree, which grew, without doubt, from berries that had fallen into the heart of the old mulberry trunk, usurped its place; this elder tree died in 1826, and then—*thirty-six years after the destruction of their parent stem*—about a dozen of mulberry shoots started forth to the light of day.—*Ann. de Sciences Nat.* ix. 338.

Marine Application of Wind Mills.—The brig Hannah, Captain Bartlett, of Plymouth, having, in a recent voyage, sprung a leak, it required three thousand strokes of the pump per hour, to clear the water that was thus introduced; and, had it not been for a wind-mill, which had been previously attached to the pump by Captain Bartlett, the ship must have filled, as all the crew were completely exhausted with constant pumping, and were exposed to continuous gales for thirty-five days. When blowing fresh, the mill would make 2400 strokes of the pump per hour.—*Newspapers*.

Excessive Cold.—The cold was so intense during the past winter in Siberia, that at Krasnoi-Jansk, quicksilver remained frozen during forty days. It was with much difficulty that people could breathe in the open air.—*Newspapers*.—The freezing of quicksilver is by no means an uncommon circumstance in Siberia, where the thermometer has been known to sink as much as 118 deg. below zero—that is, 78 deg. below the freezing point of quicksilver, (40 deg. below 0). In our temperate climate, the thermometer seldom descends, in winter, more than 15 deg. below the freezing point of water.

NEW PATENTS.

Thomas Lawes, Strand, London, lace-manufacturer, for improved thread, to be used in the manufacture of bobbin net lace.—29th March—6 months.

Charles Harsleben, of New Ormond-street, Middlesex, Esq. for certain improvements, chiefly applicable to the propelling of ships and other floating bodies.—3 April—6 months.

John Gottlieb Ulrich, of Cornhill, London, chronometer-maker, for improvements in chronometers.—19th April—6 months.

MINOR CORRESPONDENCE.

Important Invention in Gunnery.—Sir,—In your Magazine of the 22d July, 1825, "A Sportsman," under the above title, announces the invention of a gun or guns, on an entire new principle, by Lieutenant Downing, of Bideford, Devon, and for which he was about to obtain a patent. Can "A Sportsman," or any of your readers, inform me if this invention has succeeded? If it has, where a gun may be inspected; also to state the price, and any other particulars. This will confer an obligation on, Sir, your obedient Servant, E. Y. R.

Steam Engine without a Beam.—Sir,—In No. 88, vol. iv, p. 50, is a description of a single barrel hydraulic pump, with double action. It has occurred to me, that the same machinery may be applied with advantage to the piston of a steam engine, and a rotary motion immediately obtained. Perhaps this hint may be of service to some of your readers; at the same time its disadvantages explained, will be serviceable also to yours, with respect, WM. ANDREWS.

INTERIM NOTICES.

We regret to find that several articles intended for insertion this week have been left out for want of room;—among others, Mr. Utting, on Falling Bodies; and F. on the Septenary System. The conclusion of the subject of Fire-Escapes we have been also obliged to defer for a week.

C. A. B.—Yes.

We have tried, but in vain, to make out the meaning of L. P.'s communication. He will, perhaps, favour us with a more legible copy. It seems to relate to a matter of some interest.

Communications received from G. S.—Mr. Davy—Deutero-Intimator—R. Jackson—E. J. G.—Mr. Brew—W. B.—Sherwood—A Member of Gray's Inn—Mr. Woods, jun.—Smnopq—A Subscriber—F.—W. N. C——d.—The National Repository—J. Badham—Naython Copcake—The Thames Tunnel Company.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster Row, London.

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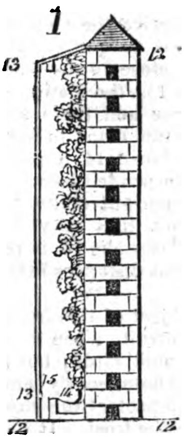
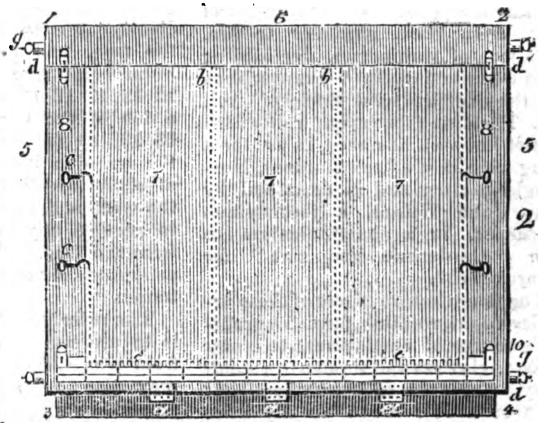
Mechanics' Magazine,

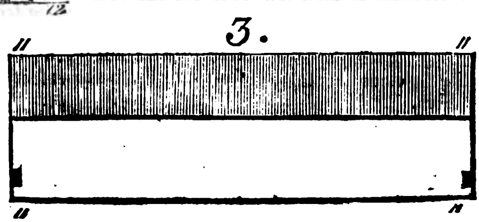
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

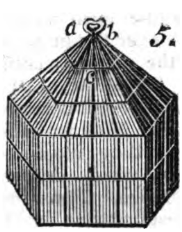
No. 251.] SATURDAY, JUNE 7, 1828. [Price 3d.

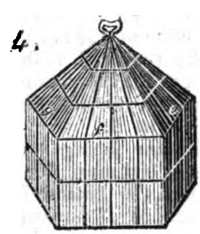
FRUIT GUARD AND FLY TRAP.

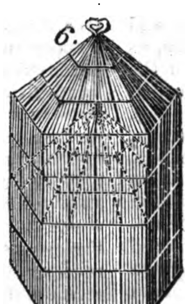












FRUIT GUARD AND FLY TRAP.

We know not that at the present season of the year we can render a more acceptable service to many of our readers, than by making them acquainted with the two simple, yet highly useful, inventions represented in the prefixed engravings.

The fruit guard is the invention of Mr. John Dick, gardener to Mr. Trotter, of Ballindean, Perthshire; and described in the "Transactions of the Horticultural Society," vol. vii. The trap (the inventor of which is not known), has been in use for a long time in Welbeck Gardens, Nottinghamshire; and is described by Mr. John Wilson, a journeyman gardener, in a communication to the "Gardener's Magazine" for March, 1827.

The manufacture of one of these articles might, we think, furnish a profitable source of employment to many master glaziers and tinmen in a small way, and even to journeymen out of work. We mean the fly trap, which is as applicable to houses as gardens, and would be found particularly useful in shops, coffeehouses, and taverns,—the places usually most annoyed by flies.

Description of the Fruit Guard.

Fig. 1 is a sectional view of the guard, applied to a garden wall; figs. 2 and 3, a front view and plan.

1, 2, 3, 4 is a square wooden frame; 5 5 wooden facings fixed on the front edge of the sides of the frame, for the reception within them of a screen of thin semi-transparent cloth (spun from the best flax, and sold in Dundee at 5d. per yard); 6 *a a a* are similar facings on the top and bottom, but moveable on hinges, as shown in the bottom facing, for the convenience of putting the rings of the screen upon the iron wires *g g*. 7 7 7 are the breadths of the screen, strengthened by slips of tape *b b*, sewed upon the seams. 8 8 are two upright pieces of wood (to which the screen is nailed), which slide under the facings 5 5, and are secured by the hasps *c c c c*. *g g* are the iron wires on which the screen slides, by means of rings; *d d d d* are thumb-screws, for tightening the wires, and preventing them from relaxing; *e e e e* are the rings on the bottom wire. When the screen is adjusted, the lower facing *a a a a* is folded up to 10, and fastened with square buttons *f f*. 11 11 11 11 (fig. 3), the plan of the wall and bottom of the frame, with a semicircular hole cut in the latter, sufficiently large to receive the stem of the tree, and thus to permit the frame being fixed close to the wall. 12 12 12 12 (fig. 1), the section of a side of the frame and the wall; 13 13, top and bottom stops, to keep the screw in its place; 14, a piece of cloth loosely suspended between the wall and the upright stake 15, to receive any fruit that may fall from the tree. The stake 15 is repeated at convenient distances in the frame.

The principal object of this frame is to protect wall-fruit, when ripe, from wasps, flies, and birds; but it may also be advantageously employed in spring, to protect the blossoms of trees from the frost. It has been used in the gardens of the Horticultural Society, at Chiswick, and found to answer perfectly.

Description of the Fly Trap.

Take a common hand-glass, of the hexagonal or any other form (see figs. 4 and 5); remove, in the apex, three of the panes *a b c*. Then take a second hand-glass, which must be of the same form as the first, and place it over the first, so that the sides of the one may coincide exactly with the sides of the other (see fig. 6). Should there be any interstices left between the two (as at *e f g*), they must be stopped with moss, wool, or any other suitable substance. The outer hand-glass must rest on three bricks, so as to leave an opening underneath for the entrance of the flies. The appearance of the trap, when completed (fig. 6), is simply that of one hand-glass above another. When waste fruit or brown sugar is laid on the ground under the glass, the flies are speedily attracted to it; and on seeking to retire, they invariably ascend, pass through the open panes *a b c*, into the space between the

two glasses, and buzz about there, till, fatigued and exhausted, they drop down and expire. "One of these traps," says Mr. Wilson, "placed conspicuously on the ground, before a fruit-wall or hot-house, acts as a complete decoy. It being surprising to see the eagerness with which all kinds of (winged) insects go to examine it; and seeing various kinds of their fellows within, they enter also, and fly upwards," &c. One in the window of every shop occupied for the sale of perishable commodities, such as those of grocers, confectioners, cheesemongers, &c., would, we imagine, be equally efficacious in relieving them from the swarms of flies by which they are always, in warm weather, so much annoyed, and their goods so much injured.

NATIONAL REPOSITORY.

We have received from Mr. T. S. Tull, the Secretary of the Board of Management of this establishment, the following papers:—

1. Copy of a Circular, dated 20th March 1828, communicating a Resolution adopted on the 29th of December last, "by the noblemen and gentlemen forming the Committee of Management of the National Repository," declaratory of the expediency and usefulness of such an annual exhibition of specimens of new and improved productions, &c.; which Resolution is the same as that inserted in our 244th Number.*

2. A Public Notice, which accompanied the preceding circular, "that arrangements are now making for the reception (at the rooms in the King's Mews, Charing Cross) of specimens of the new and improved productions of the artisans and manufacturers of the United Kingdom, and for opening such exhibition to the public, in the month of May next" (now the month of May *past.*)

3. A paper, of which the following is a copy:—

National Repository for the Exhibition of Specimens of new and improved Productions of the Artisans and Manufacturers of the United Kingdom, Royal Mews, Charing Cross.

BOARD OF MANAGEMENT.

Chairman—The Hon. G. AGAR ELLIS, M.P. F.R.S.

George Birkbeck, M.D. F.G.S.; John Hales Calcraft, Esq.; John Earl of Clare; Henry Drummond, Esq.; Hugh Viscount Ebrington, M.P.; Hon. G. M. Fortescue, M.P.; George Granville Earl Gower; Lord Francis L. Gower, M.P.; John Labouchere, Esq.; George Viscount Morpeth, M.P.; Hon. Granville Ryder; Dudley Viscount Sandon, M.P.; C. Baring Wall, Esq. M.P.; Alexander R. Warrand, Esq.; Hon. J. Stuart Wortley, M.P.

Treasurer—J. Labouchere, Esq.
Secretary—T. S. Tull, Esq.
Bankers—Messrs. Williams, Deacon, Labouchere, and Co.

COMMITTEE OF INSPECTION.

Chairman—GEORGE BIRKBECK, M.D. F.G.S.

OUTLINE OF PLAN.

First Class.—Entirely new and ingenious constructions of any sort, where a new principle is discovered, or one before known, but never practically adopted, is brought into operation.

Second Class.—New adaptation of some known principle, but in a manner essentially different from all that has been done before in that line of manufacture or mechanical workmanship.

Third Class.—Every sort of improvement upon a discovery already made, by which the preparation of any article is facilitated, or its utility increased. In

* A correspondent (F. F.) is angry with us for calling this an "ill-expressed Resolution" (No. 244, p. 196). We still think, that to say "it has been long a desideratum," "that an annual exhibition," &c. "would be highly conducive to the interests," &c., is a style of expression which one could hardly have expected to emanate from any well-educated body of noblemen and gentlemen. The criticism, it is true, is but "a verbal one," and "the meaning of the resolutionists plain enough." Neither can we object to their taking such shelter as they can obtain under the wings of the very learned and ancient association (the Royal Society) which has taken for its motto, "*Nullius in verba*;"—*these three words, of course, among the number.*

this class may be exhibited also such objects as are highly finished, or distinguish themselves by exquisite taste; likewise every description of elaborate workmanship, such as would not find a place in an exhibition of arts.

Sub-Committees of Inspection.—Chairman, to be in profession a Civil Engineer; ditto, a person well acquainted with Chemistry and chemical arts; ditto, a person well acquainted with Silk, Cotton, Woollen, and Linen Manufactures; ditto, a Mathematical Instrument Maker; ditto, a person well acquainted with Workmanship in all kinds of Metals.

Resolved—That the decision of the Sub-Committees, with regard to the reception of articles submitted to their inspection, as well as to the class to which they may belong, shall be final, when such decision shall have been signed by the Chairman of the General Committee of Inspection.

Resolved—That the Presidents, Vice-Presidents, and Secretaries, of all the Mechanics' Institutions in the United Kingdom be invited to take on them the office of Committee of Inspection, with power to add to their number in their respective districts, with the same power of deciding upon the admission of articles as the London Sub-Committees of Inspection; and that a circular letter to that effect be written and forwarded to the several Presidents of the Mechanics' Institutions, signed by the Chairman of the Committee of Inspection.

Persons resident in London or its vicinity, who may be desirous of availing themselves of the advantages of the ensuing Exhibition, are requested to forward the particulars, with a full description of the articles designed to be sent for exhibition, in a letter addressed to the Secretary, and to wait an answer to such letter, which will be sent to their address previously to their forwarding any package containing such articles for reception at the National Repository. Artisans and manufacturers residing at a distance from the metropolis are requested to make application to the President or Secretary of the Mechanics' Institution nearest their residence.

*** No charge will be made for a grant of a place in the Gallery upon any articles that shall have been approved of by the Committee of Inspection.—All letters sent by post must be paid.

Royal Mews, Charing Cross,
April 8, 1828.

4. Form of a Reply (dated 3d May) to Letters of Inquiry; in which it is stated that "all specimens sent to the National Repository must remain under the controul of the Board of Management until the close of the Exhibition; when they will be re-delivered to the owners, unless, at their request, such specimens shall have been sold; in which case, the amount received will be paid to them or to their order, on application at the Repository."

And, 5. A Notice, dated 5th May, from the heading of which ("Patron, the King") it appears that His Majesty has taken the Institution under his royal protection; that the Repository "will continue open daily, from ten till four o'clock, for the reception of specimens," "until the end of this month (May); when the necessary arrangements will be made for their early exhibition to the public."

Having now made our readers acquainted with all that the managers of this establishment have been pleased to make known respecting their plans and proceedings, we shall only say, for ourselves, that though we are still of the opinion we before expressed, that it is neither called for by the tastes, habits, and necessities of the English people, nor ever likely to furnish a really *national* display of their manufacturing industry and skill, it has, notwithstanding, our best wishes: it can, at least, do no harm, and may, possibly, do some little good.

The King's name is, we all know, a "tower of strength;" but we must be allowed, with every respect for it, to say, that a still better guarantee of the merits of the concern, would have been the accession of the names of a few eminent men of science, eminent manufacturers, or eminent merchants,—such as the Woolastons, the Strutts, or the Barings of our time,—to the list of its managers. The only gentleman of scientific pursuits whose name is published in connexion with the establishment, is Dr. Birkbeck; the rest of the members of this *national* Board of Management being, mostly,

young scions of nobility, whose names carry with them, as yet, but little, if any, weight.

The managers have overlooked, in their Conditions of Exhibition, one of very considerable importance, and which it is only fair every intending exhibitor should be apprized of. From our knowledge of the class of persons likely to forward articles for show, we are convinced that not one in five is acquainted with the fact, that by exhibiting publicly, or by submitting to the examination of any public Committee of Inspection, any new invention, discovery, or improvement, *before taking out a patent for it*, the inventor will forfeit his right to take out such patent, and place it in the power of any one to manufacture the article for his own personal benefit. Nobody, therefore, should send things to a Repository of this description, but such individuals as have either taken out patents, or have no intention of doing so.

FIRE-ESCAPES.

Sir,—In compliance with the flattering invitation given me at page 148 of the "Mechanics' Magazine," I beg leave to occupy another small portion of its valuable columns with a few additional observations on the subject of fire-escapes.

Your correspondent, "H. I*****," will, no doubt, have perceived, by my former communication, that his fire-escape is surpassed by one already before the public. I allude to that of Mr. Young (see page 212), which is something similar to the one proposed by your correspondent, with this exception, that Mr. Young's ladder is so constructed as to contain within itself the means of raising it to any required height; whereas that of "H. I*****" requires a separate and rather complicated instrument to effect that purpose. Next follow the three plans of your correspondent "J. S. S." (page 162). Of the first, I may observe, it *may* be used where the windows of the adjoining houses are on the same level; but this is not always the case. To escape from one window to another, on the same floor of the house on fire, would give no advantage. Should the person in danger, in the agitation and confusion of the moment, omit to make this apparatus secure before he trusts himself to it, he will be in danger of meeting a fate as bad as that from which he is endeavouring to escape. But supposing, for a moment, that this apparatus were properly secured, it would require no ordinary nerve to tread the "giddy footing." Females or children could not be saved by this means. The second plan is free from these objections; but fixing the supporting rods of the basket would *not* be the work of a moment. The third plan is the most preferable of the three.

A few days after I had forwarded my former communication, a lithographic circular was put into my hands, containing a description of a new fire-escape. The inventor, Mr. J. C. Hesse, terms it the "Anti-ignitious Fire-escape." It consists of a rope, twice the length of the window from the ground; to this is attached a bag, kept open at the mouth by a hoop. The whole is rendered incombustible, from whence it takes its name. To use this apparatus, the bed is to be drawn close to the window, the rope passed once or twice round the bedpost, and thrown out of the window; the bag is then to be placed outside the window. Men, women, or children, may be put into it and lowered; either by keeping hold of the rope themselves, or by the aid of watchmen, or other persons below. Any person may construct a fire-escape of this description at a trifling expense. Any kind of sack will do, and may be rendered partly incombustible, by soaking it in a solution of alum. This is not, however, absolutely necessary, as the flames seldom rush from the lower windows with such fury as to endanger this apparatus.

By a paragraph in the newspapers, I perceive that Mr. Read, the ingenious inventor of the Stomach Pump, has been making some experiments at a house in Regent-street with a fire-escape, something similar to the above, with great success. This

fire-escape is calculated for the bed-chamber only, and is of little use in the hands of watchmen or firemen, from the difficulty of forming a communication from the street with the persons in danger; as it could not be raised to the window of a house, unless some addition were made to it, which would add to the expense and diminish its simplicity.

Mr. Hesse, to remove this objection, states that a communication may be effected with the persons requiring assistance, by tying a stone or brick to the rope, and throwing it in at the window. With a two or three story window, however, this method is impracticable, as its proposer would have discovered, had he made the experiment.

It is but justice to Mr. Gregory, of Bagnigge Wells Road, whose ladders I noticed as "not being sufficiently portable to be of much extensive service," to inform your readers that he has greatly improved and simplified his escapes, having omitted the carriage, and added a folding cradle, which is made to slide on the ladders, for the reception of females, &c. &c.

I have seen an escape ladder constructed by this gentleman, consisting of two one-story ladders sliding one on the other; to the lowest step of the upper ladder an endless cord is attached, and passes round the upper and lower steps of the under one; this cord, pulled downward, raises the ladder, which is secured at any required elevation by a hook, fixed to the bottom step of the moveable ladder, and taking hold of any of the steps of the other one. This ladder, when closed, occupies the room of a one-story ladder only; is extremely light and portable; and, when raised to its full extent, is sufficiently long to reach any second floor window; higher than which a fire-escape is very seldom required.

Mr. John Hudson, No. 8, City Gardens, has constructed a model of a new fire-escape invented by him. It consists of a mattrass, 12 feet long by 6 feet wide, stretched on a frame, and mounted on a carriage. It shuts up close in the form of a square chest, and, on arriving at a fire, is opened in an instant; it is then ready for the reception of those persons who are driven to the dreadful necessity of precipitating themselves from the windows, and would doubtless preserve them from injury. It is also calculated for the reception of such property as time will allow to be consigned to it. On referring to page 213, it will be seen that a plan, with the same object as the foregoing, was proposed by Mr. Samuel Buston, possessing several considerable advantages over that of Mr. Hudson; being much less expensive, more effectual, and more likely to be at hand on the most sudden emergency. The plan of Mr. Buston now rests entirely with the public, its enlightened proposer having been suddenly cut off while taking steps for bringing it into immediate practice. The apparatus from "A Member of the Richmond Mechanics' Institute," in No. 247, is proposed for the same purposes, with the same name, and on the same principle, as that of Mr. Roberts, rewarded by the Society of Arts, alluded to in my former communication, and differs but slightly in the mechanical detail. A most singular coincidence, certainly.*

From the evidence of experienced persons, as well as from my own personal observation, I am perfectly convinced that *no one fire-escape* is sufficient to ensure the safety of the inhabitants of a large and populous parish; and that none of the fire-escapes yet proposed on carriages are of any service, except in the immediate vicinity of the spot where they are stationed. It is imperatively necessary, as I before stated, that all persons inhabiting houses, not furnished with *natural* means of escape from the upper stories, should provide themselves with some kind of fire-escape, if they wish to secure perfect safety; for it is in this, as in

* For the name, at least, the "Member of the Richmond Mechanics' Institute" is not responsible; that was conferred by the Editor, to whom the account was transmitted without any title prefixed.

every other calamity of life, that persons, by trusting to the "*vague chance*," lull themselves into an imaginary and groundless security, and are taken by surprise in the most distressing state of helplessness.

On an examination of this metropolis, it will be found that nineteen houses out of twenty have natural and easy modes of escape; it would, therefore, be much better for the inhabitants of this twentieth house to provide themselves with some certain means of escape,* than to trust to that likely to be afforded them by the great majority of persons forming the disinterested part of their parish.

Having entered thus far into the mechanical details of the subject, I cannot conclude without alluding to the office of Parish Engineer. In numerous instances this office is attached to that of Beadle, or Sexton; and it most frequently happens that the persons well qualified for the latter offices are quite incapable of fulfilling the duties of the former. In other instances this office, like "kissing, goes by favour;" and two instances have lately come under my own observation, wherein two experienced firemen have been rejected for two persons entirely ignorant of the construction or management of the valuable machinery entrusted to their care. In filling this office, the parishioners should consider it as a case of life and death, and not place their lives and property in the hands of persons incompetent to assist in the preservation of either. Unless this office is filled by an experienced person, it had always much better be vacant; for, to use a vulgar saying, "it is trusting to a rotten stick."

I am, Sir,
Yours, &c.
W. BADDELEY, jun.

10, *George-yard, Lombard-street*,
May 14, 1828.

Sir,—I have read, with much pleasure, Mr. Baddeley's review of Fire Escapes (No. 245). His remarks upon my method of breaking a hole through the party wall, however, contain no objection that I had not anticipated, except as to the length of time requisite for performing that operation. I have said *five minutes*, and with this the opinions of both carpenters, bricklayers, and labourers, agree. There is not anything, however, more easy than to ascertain what the exact time would be, under various circumstances.

Amongst your numerous readers, perhaps, every day presents an opportunity, in the pulling down of old houses, of deciding the matter by experiment. Probably the tools best calculated for the purpose are either a bricklayer's axe, a crowbar, or a mallet and chisel. The use of either of these instruments will, I should think, require less presence of mind than would be necessary to fix any other fire-escape whatever depending upon external aid.

I cannot for a moment entertain the idea that the method is at all desperate; and I should suppose, that if Mr. B. actually saw a hole in a party wall no larger than would be requisite for one person at a time to get through (all other parts of the wall being proof against fire), he would not be at a loss to find means to prevent danger to the adjoining house; and if a fire-man, or more especially so many men as would be requisite to convey a ladder and erect it in *five* minutes, could not accomplish such a thing, they would be unfit for their situations; and any office employing such men would deserve to pay for the loss of property occasioned by such a want of skill in their own men. A fire-man who would not attempt, or a neighbour who would not allow, a hole to be made through the party wall, if that were practicable, and no other means at hand, to save a fellow-being from the flames, would deserve the severest censure. I trust that some one will have the goodness to say, if such a method had been resorted to, whether any of those lives recently lost might have been preserved.

If it were made a law that, on such an emergency, a hole might be made

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* Such, for instance, as that of Mr. Hesse, described above.

in a party wall, I do not think the rate of insurance would be at all increased. This being done, the neighbour would not be at any risk; and if firemen connected with insurance offices are more anxious to save their master's property than human life, they should be no longer intrusted in such cases with this most urgent and imperative duty.

In a country abounding with Humane Societies, it is somewhat surprising that an Institution has not yet been formed to render assistance in case of fire. The Royal Humane Society, for rescuing persons from a watery grave, with little additional support, would, perhaps, extend their benevolent efforts also to rescue human life from devouring flames,—should it be supposed that the watchmen cannot be equipped so as to render all the assistance requisite.

To those who wish to provide themselves with a rope fire-escape (although I think very few women or children, and certainly few aged, infirm, or sick persons could be rescued in safety by such means), I beg to suggest that such a rope might be wound upon an horizontal wheel, which might turn in a box fixed immediately under the sacking of the bed. A fringed rope has been recommended, and, I believe, manufactured, for such purposes.

Perhaps Mr. B. would favour your readers with a comparison of the expense of supplying all London with ladders, so that one might, in the event of fire, be taken to any house in five minutes, with the expense of those plans I have had the honour to propose, and which you have so promptly laid before your readers.

Since writing the former part of these observations, I have seen an account of Mr. Read's exhibition of his rope fire-escape, in Regent-street; and I now beg to enumerate a few reasons, which have occurred to me, why the public must not depend on that means alone as being sufficient to exculpate them from all blame in the event of any more persons being burnt to death, in sight of the firemen and their neighbours.

In the first place, any plan requiring several fire-escapes in every house, and depending on as many persons as there are houses for being provided and constantly kept in order, is perhaps more than can be reasonably expected; to say nothing of the first cost of a general application.

Secondly. If such an apparatus be provided at the least possible expense, it will be very unsightly; indeed, few ladies would like to see a rope 80, 100, or 120 feet long (which must have been the length of Mr. Read's), constantly in their bedrooms; and if any inclosure, either plain or ornamental, be added, the expense will be greatly increased.

Thirdly. Various improper uses may be made of such a contrivance; for, as well as descend, persons may *ascend* by such means into your house.

Fourthly. If the upper windows of a house have the lower sashes fixed, or bars across, to prevent children from falling out, this, as well, indeed, as those external contrivances I have pointed out in such cases, cannot be conveniently applied.

Fifthly. Unless an active man were present in every case of fire to conduct the descent of children, females, and aged persons and invalids, I doubt much if they could be saved by such means.

Sixthly. In the event of the flames having broken through the lower windows, there would be great danger in passing them, especially with any rope apparatus.

There would be some little difficulty in the general application of the fire-escape (No. 247); and I doubt whether it would be sufficiently steady. In many houses in London, in consequence of the areas before our windows, it could not be placed sufficiently close; and if placed on to the landing at the door, the balconies would interfere with its being elevated. Should, however, these difficulties be surmounted, as I think one machine in a parish would not be sufficient, I beg to suggest that bricklayers, or any other persons who may keep such a machine, should be entitled to a reward for being first at a fire; the reward to be paid by the Society for Extricating Persons from Houses on Fire, should one be formed.

From these observations it will appear that I do not consider either of these improvements ought in the least degree to induce me to relax in my urgent entreaties that the hole in the party wall may not be lost sight of, but that it may be tried rather than any individual should suffer so appalling a death; and I still think that for the safe and speedy escape of every description of persons, it is superior to all others, inasmuch as there is no plan with which I am acquainted that will cost so little in a general application. If only one set of tools be calculated for every hundred houses, several sets may, if required, be in a very short time brought to any house on fire. If in future any life is lost in the presence of firemen, acquainted with this suggestion and with time to apply it, I will not name the crime of which I conceive they would be guilty; and I think if your correspondent Mr. B., or any friend of his, were to be that unfortunate individual, he would give the crime the same designation.

I am, Sir,
Yours, &c.
J. S. S.

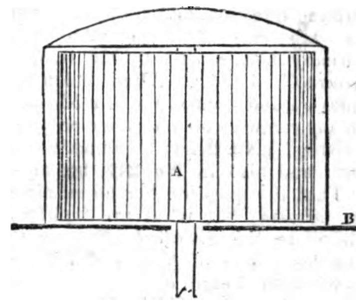
[There are still two or three more communications on this subject, which will oblige us to return to it shortly.—EDIT.]

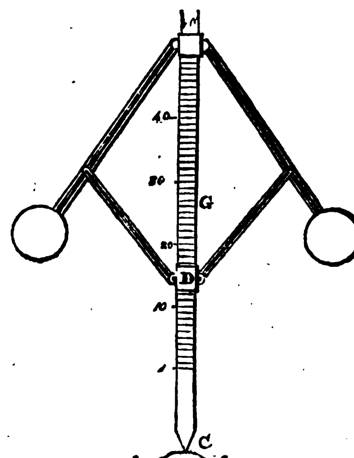
IMPROVED WIND-GAUGE.

Sir,—The following is a sketch of a wind-gauge, which is, in some respects, preferable to the common one.

A is the common revolving cover of a chimney-pot, furnished with a long shaft, which, passing through the house top B, turns in a pivot hole at C.

To the shaft is fixed a small governor (which is easily constructed), the moveable collar of which D will rise or fall, according to the velocity of the wind, and of the whirling motion given to the balls. The shaft is graduated with equal degrees; equal, because the vertical height to which the balls, and, consequently, the collar D, will rise, is the measure of proportionate velocity, and not the section of a circle which they describe.





The only inconvenience the reader may expect in consulting his wind-gauge (or ventimeter, if you like it), will be an occasional *blow* on the head, which may, however, serve to remind him to keep it out of the way.

I have given the above in its most simple form, and will just add, that it is easy to apply the moving power, either to a dial, or anything else.

I am, Sir,
Yours, &c.
JOSEPH BROWN.
Cannon-street.

PILE-DRIVING.

Sir,—In No. 247 of the "Mechanics' Magazine," a paper is inserted

on Falling Bodies, by Mr. Mackinnon, in which he says—"In No. 232 Mr. J. Utting takes up the pile-driving question, and does *not differ in any respect* from what has already been stated by Mr. B. and *himself*," &c. &c. After which he goes on and accuses me of a *blunder* in my remarks on his paper on pile-driving! (No. 210); in which number, and also in No. 247, he says, "That the question has no *maxima* or *minima*, but what are *infinite!* therefore the *greatest* effect, with the *least* loss of *time* and *labour*, is when the height of the pile-engine is *infinitely small!!*" Now, what does this imply, but that the ram must be in a state of quiescence? If the height of the engine be infinitely small, there can be but little room for his ram to play; and therefore I am in no danger of being butted by his horns!!!

The above formula is, however, fallacious, and will not give the maximum effect of the ram. There is a certain height of the engine required to produce this effect, and which can only be ascertained by experiment. According to Mr. M.'s formula, the effect of a ram of one inch or one foot fall, in a given time, is greater than that of a ram with a fall of ten feet; and until Mr. Mackinnon can prove this, I shall not be convinced of the truth of his theory. And in respect to the error he imputes to me in the misconception of his statements, this does not, I think, require any further remarks on my part, till such time as Mr. M. can advance something better than assertion for the pretended blunder I have committed.

I am, Sir,
Yours, &c.
J. Utting.

Lynn, May, 1828.

P. S. It appears evident to me that no formula will give a *maximum* effect of the ram on a *pile*, as so much depends on the nature of the soil it has to penetrate.

In moory soils the pile would probably sink into the earth from the mere pressure or weight of the ram; but in soils which oppose a greater resistance, the effect produced by the ram would be considerably augmented by the effects of *percussion*, and would, in higher engines or in greater falls, considerably exceed the ratio denoted by the computed momentum of the ram.

J. U.

DESCRIPTION OF A MACHINE, INVENTED BY TRUCHET, TO EXEMPLIFY THE THEORY OF FALLING BODIES.

(From the French of our Correspondent "F.")

Sir,—The different articles which you have printed on the Fall of Bodies, have recalled to my recollection an ingenious machine, invented in 1699 by Pere Sebastian Truchet to prove the system of Galileo. The following description of it cannot but be interesting to your numerous readers:—

This machine is composed of four equal parabolas, which intersect each other at their summits, making equal angles, and have a common axis, perpendicular to the horizon. This forms a paraboloid, around which turns a spiral, composed of two parallel brass wires, which form a very straight inclined plane, so disposed that the first turn of the spiral is one inch in diameter, the second three, the third five, the fourth seven, &c. These turns of the spiral, which are to each other as their diameters, represent the unequal spaces through which bodies ought to pass in equal periods of time. On dropping, therefore, a small ivory ball of six lines in diameter from the summit of the paraboloid, it will traverse all the turns of the spiral in the same time; or the fact may be still better demonstrated by two ivory balls of the same size revolving round a paraboloid in the same time, and at a fixed distance from each other; for when they pass you at the same instant upon the same arc of one of the parabolas, they will be found to continue to go uniformly round together, and to complete their revolution at the same instant.

F.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(Continued from p. 299.)

31. The examples which we have here given will enable us to make an application of the fluxional expressions for the areas, contents, and surfaces of solids; the consideration of the length of a curved line we will reserve till we have said something respecting what is called the Correction of Fluents. The general fluxions of areas, surfaces, and solids, are, we may remember, arranged in a Table, p. 299. Substituting, in the expression $y.\dot{x}$, $\sqrt{4ax}$ for y, which is its value in the parabola, we have $\sqrt{4ax}.\dot{x}$ for the fluxion of the area of that curve. Similarly, by putting $4ax$ and $2rx-x^2$ (which latter quantity is given by equation 2 to the circle), in the expression $cy^2.\dot{x}$, we have $4cax.\dot{x}$ and $(2crx+cx^2).\dot{x}$ for the fluxions of a paraboloid and sphere. To find the fluxion of the surface of the sphere, we must substitute $\sqrt{2rx-x^2}$ for y, in the expression $2cy.\sqrt{\dot{x}^2+\dot{y}^2}$; and for the symbol $\dot{y}$ under the root, we must put the fluxion of $\sqrt{2rx-x^2}$, we have shewn to be

$$\frac{\overline{r-x}.\dot{x}}{\sqrt{2rx-x^2}}.$$

By this we obtain for the fluxion of the surface,

$$2c.\sqrt{2rx-x^2}.\sqrt{\dot{x}^2+\frac{\overline{r-x}^2}{2rx-x^2}\dot{x}^2}$$

$$=2c.\frac{\sqrt{2rc-x^2}}{\sqrt{2rx-x^2}}.\left\{2rx-x^2+(x^2-2rx+r^2)\right\}^{\frac{1}{2}}.\dot{x}$$

$=2cr.\dot{x}$.

32. Arranging these results, we have

The fluxion of the area of a parabola . . $=2.\sqrt{ax}\times\dot{x}$

Do. contents of a paraboloid . $=4cax.\dot{x}$

Do. contents of a sphere . . $=2crx.\dot{x}-cx^2\dot{x}$

Do. surface of a sphere . . $=2cr.\dot{x}$

33. Referring to Table II. (p. 299), we find that the quantity $\frac{4}{3}.\sqrt{ax}.x$ has the same fluxion $(2.\sqrt{ax}.\dot{x})$, as the area of the parabola. Hence we conclude* that the quantity $\frac{3}{4}.\sqrt{ax}.x$ is equal to the area of the parabola $\frac{2\sqrt{4ax}.x}{3}=\frac{4}{3}.\sqrt{ax}.x$; and putting for $4ax$ its value y in the equation (B), to the parabola, we have $\frac{2}{3}.xy=$ area of the parabola; that is, the area of the parabola is equal to two-thirds of the circumscribing parallelogram; a result which agrees with that which we before deduced by the method of Indivisibles.

By referring, in the same way, to the Table, we find that the quantities $(2cax^2)\left(crx^2-\frac{cx^3}{3}\right)$ and $2crx$ give the same fluxions, $4cax.\dot{x}$ $(2crx-cx^2)\dot{x}$, $2cr\dot{x}$, as the solid contents of a paraboloid and sphere, and the surface of a sphere, respectively.

Whence we conclude that

$2cax^2=$ solid contents of a paraboloid;

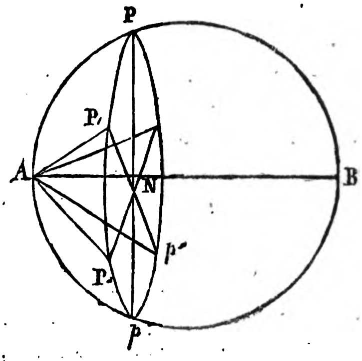
$crx^2-\frac{cx^3}{3}=$ solid contents of a spherical segment;

$2crx=$ surface of the same segment.

Here x represents the length A N of the segment. If we make $x=$ A B (or $2r$), we have the solid content and surface of the whole sphere $\left(=4cr^3-\frac{8cr^3}{3}\right)=\frac{4cr^3}{3}$ and $4cr^2$, respectively. The last quantity,

* This is to be understood with certain restrictions, which we shall explain when we come to treat of the Correction of Fluents.

$4\,c\,r^2 = 4$ times the area of the great circle A P B. And hence the sur-



face of a sphere is four times the area of a circle of the same radius. Suppose from the expression $\frac{4\,c\,r^3}{3}$ it is required to find the solid content of the earth. The radius of the earth being about 4000 miles, we have

$$\frac{4\,cr^3}{3} = \frac{4 \times 3.14159 \times 64000000000}{3}$$

$=267,228,160,000$ cubic miles for its solid contents.

34. We have referred to a Table, to find the algebraic expressions which give the same fluxions as the above areas, solids, and surfaces, in order that by this reference to results previously obtained, we might impress on the mind of the reader, that it is only by observing how a fluxion has been already found from a fluent or variable quantity, that we are enabled to retrace our steps, and determine the fluent from the fluxion.

(To be continued.)

MECHANICAL CHIMNEY-SWEEPING.

Sir,—It has often occurred to me (as I believe it may have done to many others who have employed their thoughts in originating mechanical inventions), that things on which I have spent much time, and mental cogitation—nay, often more than thought—in arranging, have been anticipated by others. Such was the case completely, respecting the plan for sweeping chimneys, in your 243d Number. But besides the brush or broom, which I think would be scarcely sufficient to bring down the caked or crusted soot, I intended to have another head, with a scraper, constructed as follows:—

Supposing a flue to be a foot square, I would have a scraper of nearly that breadth, with a spring to the back of it, in which there would be a roller; so that while it forced the scraper forward powerfully against the opposite side of the flue, it would still permit it to move up and down. By a turn or two of the thumb-screw, at *a*, the power of the spring would be increased, and the scraper made to enter flues of different dimensions.

I am, &c.

C. A. BREW.

Ennis, April 18, 1828.

We recommend the above suggestion to the consideration of the Committee of the Society for Superseding the Necessity of Climbing Boys; to whom it will not make it the less deserving of attention, to mention that it comes from one of that eminently philanthropic body of Christians, the female members of which, so highly to the honour of their sex and their persuasion, mustered in such numbers at the General Meeting of the Society, held at the Egyptian Hall on Saturday last. We were glad to learn, from what took place on that occasion, that it is intended to *apply again to Parliament;* and trust it will be for nothing less than such an Act of positive prohibition as we spoke of in our 243d Number. Nothing short of that, we are convinced, will do. Were it usual to see such long-established usages as that which is here sought to be abolished, spontaneously abandoned from a feeling of humanity alone, a compulsory law would have been no more necessary for the protection of the poor African, than one is now for the salvation of hundreds of British infants, equally deserving of protection, and equally maltreated. Among many proofs which were laid before the Meeting of the superior efficacy of mechanical chimney-sweeping, Dr. Birkbeck read a letter

from Mr. Stratton, of the Banbury Committee, which stated that they had caused two chimneys to be swept—one first by a boy, and then by a machine; the other, first by a machine, and then by a boy: and the result was that the machine brought down double the quantity of soot after the boy, that the boy did after the machine.—EDIT.

NEW PUBLICATIONS
Connected with the Arts and Sciences.

A Treatise on the Cause and Cure of Hesitation of Speech, or Stammering, as discovered by HENRY M'CORMAC, M.D. 112 pp. 8vo.

WHEN we repeated the lamentation of M. Majendie, (Mechanics' Mag. No. 243, p. 191), that Mrs. Leigh, the discoverer of the cure for stammering, which has of late been so much talked of, had "not conformed to the honorable practice established in our days, of rendering public every discovery beneficial to humanity," we little expected to be so soon able to announce to our readers, that the system which Mrs. L. and her confidants have kept so profound a secret, has revealed itself to the sagacity of another individual, who, penetrated with a juster sense of the glory of being useful to his fellow creatures, now lays the whole particulars of it before the world.

"Being in the city of New York," says Dr. M'Cormac, the author of the book before us, "in the latter end of the year 1826, I was given to understand, that a Mrs. Leigh, of that city, was in possession of means, which she exercised with success, for the removal of stuttering or stammering. I did not pay at first, nor would I subsequently have paid, much attention to this piece of information (as I should have merely noticed it as a new instance of charlatanism), but it was also accompanied with the assurance that Mrs. Leigh had obtained, from several of the medical gentlemen of New York, (men incapable of lending their names wilfully to shield an imposture), certificates declaring their belief in the truth of her allegations; they were also, I was told, admitted into her confidence, after a solemn assurance, on their parts, that they would not betray it. Hence they became, without the possibility of failure, competent judges of her method of proceeding, and of the results. In this, indeed, they could not be mistaken; they saw that the same means invariably produced the same results, and gave their testimony accordingly in favour of Mrs. Leigh's system.

"I was much gratified at the receipt of this intelligence, as it gave me every reason to believe, that stammering, which I had hitherto believed incurable, was by no means so, but quite the reverse; at the same time, I was grieved to think, that a discovery of so much importance to mankind, should be exercised only for the benefit of those few whose time and fortune permitted their having access to Mrs. Leigh's services.

"This account, indeed, greatly excited my curiosity, as to the means by which an affliction so grievous, and hitherto irremediable, could be removed or alleviated; but, unless by the exercise of whatever intellectual sagacity I possessed, I saw no means of arriving at the knowledge I was in quest of, so as to be able to communicate it. My regret at this, however, was much abated, when I considered that *what another had done, I might possibly do likewise.*

"It occurred to me, that the best way to begin, would be to consider the nature of the disease, and, if possible, to unravel the process of its action. This I did, with the desired result; and, to my satisfaction, found that the cause hitherto so inscrutable, was one, not only easy to be understood, but capable of being annihilated with the utmost facility, in a short time, by any one who was, with myself, aware of the secret.

"My delight at the discovery, though great, was certainly not to be compared with my astonishment, from its extreme simplicity, at its not having been sooner made."

Simple this long sought after cause indeed is, and equally simple the cure. Stuttering, be it at length known, is nothing more than the natural effect of attempting to speak *when the lungs are in a state of collapse*, and is, of course to be cured by regularly supplying the lungs with the quantity of air necessary to speech.

"The primary cause," says Dr. M. "of psellismus (stuttering), in common with many other irregular or abnormal affections, arises from the want of knowledge in the patient to put his organs in the proper train for executing the desired freedom of action; but the proximate cause in most cases *arises from the patient endeavouring to utter words, or any other manifestation of voice, when*

the air in the lungs is exhausted, and they are in a state of collapse, or nearly so. In this consists the discovery, hitherto made by none; or, if made, not announced. The patient endeavours to speak when the lungs are empty, and cannot. Why? Because the organs of voice are not struck by the rushing current of air: they do not vibrate; therefore voice or speech cannot take place. In vain do we press down the keys of an organ—the many-toned tubes will not vibrate without the air rushing through them: so in vain do we place the *chordæ tendinæ*, and the muscles, and the membranes, and the bones of the air tubes, and of the mouth and the nose, into a proper position; words will not follow our efforts, any more than they can issue *simply* from the moving lips, an automaton of departed men, imagined by our ancestors."

The truth which Dr. M. here seeks to inculcate, may be made still more manifest, by reminding the reader of the familiar effect of stopping the air valve of a pair of bellows, when in the act of blowing a fire. The difficulty experienced in that case, is precisely the same as that which a person feels when he attempts to speak with his lungs in a state of collapse; the bellows will not blow, nor the mouth give forth sounds, because neither is supplied with the air necessary for the purpose.

The main thing to be attended to in the way of cure, "is to expire the breath strongly each time when attempting to speak, the lungs being previously filled to the utmost; or, in other words, to reverse the habit of stuttering, which is that of trying to speak without expiring any air." Dr. M. thinks, that a person of mature age and ordinary sagacity, being thus put in possession of the principle of the curative process, may easily cure himself; but if the individual who is affected be very young, he allows that it will be necessary to place him under the superintendence of another. The better, however, to enable persons to cure themselves, or to undertake the cure of others, he has given a series of minute directions for the purpose; by due attention to which, "the most inveterate and confirmed habits of stuttering, no matter of how many years duration, or when contracted," may "in a very short space of time" be removed. The price of the book containing these directions, is but *5s. 6d.*; as much as fifty and a hundred guineas have been heretofore paid to professional curers of stuttering, for information and assistance, not half so satisfactory as that which is thus cheaply promulgated.

Dr. M. does not rest his confident assurances of the efficacy of the mode of cure here pointed out, on the mere reason of the thing, strong as that is. Since returning to Europe, in the latter end of the year 1827, he has "essayed the truth of his theory on more than one individual," and his experiments have been "crowned with perfect success." Of the happy issue of his labours, Dr. M'Cormac speaks in a tone of justifiable exultation. There is no degree of satisfaction which can be derived from the consciousness of having conferred a great and lasting benefit on society, in which Dr. M. may not warrantably indulge; nor any extent of philanthropic and professional celebrity, which he may not confidently anticipate. He claims not, it is true, to be the only, or even the first, discoverer of the cause of this very prevalent disease, and the means of curing it, but he affirms with truth, that though not (probably) the first to make the discovery, he has been the first to make it known to the world; while others, who have been in possession of the means of removing hesitation of speech, have preferred converting their knowledge into a source of mere personal emolument. Dr. M. has nobly contemned all such sordid considerations, and made a spontaneous offering of the fruits of his skill at the shrine of humanity.

The Perpetual Guide for the Equitable Adjustment of Builders' Prices. By William Thorne, Architect and Surveyor. 308 pp. 8vo.

The present cannot be strictly called a *new* book, a Prospectus of it having issued as far back as 1822, and the work itself published in 1824; but we suspect that, though a work of rare merit, it is still as little known to the majority of persons concerned in "Builders Prices" (and how few are not?) as any new publication to which we could invite attention. It has been transmitted to us by a correspondent, who states that he has "no acquaintance with the author," and recommends it to our notice "solely from a wish to see rescued from undeserved neglect a work of extraordinary industry and talent, from which he has himself derived great benefit, and which is calculated to benefit equally all other persons in the same line of business." (*Master Builder.*)

We have ourselves looked over the work

with some care, and fully concur in the description given of it by our correspondent. It is, indeed, a work of "extraordinary industry:" the mere labour bestowed upon it must have been immense. More than nine-tenths of it are occupied by very closely printed tables of figures, which exhibit, at every probable difference of rate, and in almost every possible variety of shape, the prices of all matters and things connected with the building art, and falling within the respective provinces of the builder, timber-merchant, sawyer, carpenter, joiner, mason, bricklayer, plasterer, plumber, glazier, ironmonger, and slater. There are explanations too, of each of these numerous Tables, and examples of the mode of using them. Nor are Mr. Thorne's Tables valuable for their number and minuteness alone; they have been planned with discrimination, and exhibit a store of information, not derived either from books or from hearsay, but evidently from a most extensive personal experience.

Mr. Thorne styles his book, a "*Perpetual* Guide," and with good reason; for though the principal portion of it was written "several years ago," and there have, since that period, been many alterations in prices, yet the Tables are so constructed, as "to meet any fluctuation whatever to which the value of building materials and labour is liable." Thus, Tables viii. to xiv. inclusive, show what is the value of 12-foot deal per foot superficial for *measured work*, whatever may be the price of such deals per hundred, whatever the allowance made for waste, and whatever the rate of profit expected. And Tables cxxxi. to cxliii. inclusive, show what, according to the prime cost of different sorts of wood, ought to be paid for the principal articles of joiners' work, as door-linings, shop-fronts, boxed shutters, &c.

The expense of printing numerical and tabular works is so heavy, as almost to shut out any hope of seeing the one before us *reprinted*; but architects and builders, and the master tradesmen under them, form a very numerous class; and should they (as they ought, and we trust yet will), by their encouragement of Mr. Thorne's labours, induce him to revise them, we are persuaded that, excellent as this "Guide" is, the author would of himself find many ways to render it still worthier of universal patronage. Something both for space and simplicity might be gained, by a mere consolidation of Tables; the use, too, of every one of the Tables might be greatly facilitated by fuller explanations, and a more distinctive style of typography. The number of errors of the press might also be so diminished, as to leave the author at perfect ease to confess and enumerate them, and not, as appears to have been the case in sending forth this first edition, so scared by the magnitude of the task, as to omit a list of errata altogether. Works of figures are necessarily more liable to typographical inaccuracies than others, and it is easier to make a large allowance on this head, than to suppose it possible that a publication like the present could be produced wholly faultless.

LONDON MECHANICS' INSTITUTION.

NO. XVI.

"These are the gifts of art."
COWPER.

LECTURES.

Friday, May 2.—Professor Millington, Hydraulics.

Wednesday, 7.—Mr. Christie, Architecture.

Friday, 9.—Professor Millington, Hydraulics.

Wednesday, 14.—Mr. Christie, Architecture.

Friday, 16.—Professor Millington, Hydraulics.

Wednesday, 21.—Mr. Christie, Architecture.

Friday, 23.—Mr. Teplis, on the Mechanical Aggregations of Matter.

Wednesday, 28.—Mr. Christie, Architecture.

Friday, 30.—Mr. Teplis, on the Mechanical Aggregations of Matter.

It is expected that in June or July Doctor Birkbeck will continue his Anatomical Lectures.

☞

MISCELLANEOUS NOTICES.

Men Food for Fishes.—After a dreadful carnage between the Turks and Austrians, on the banks of the Danube, barbels were found in unusual numbers, and of extraordinary size. A similar fact is recorded of the hake, which increased prodigiously after the engagement between the English and French, off Belleisle in 1759. The fact has been attributed, in both instances, to the supply of human flesh, for which these sorts of fish are said to manifest a partiality.

Slavery.—An effect of slavery not usually noticed, though, perhaps, as injurious as any, is this;—that wherever it prevails, it is held disreputable for freemen to labour, and idleness is all the fashion. In the middle and Eastern

counties of the Southern States of America, not one planter in thirty puts his own hand to any sort of field work.

European Mode of Reckoning the Hours of Sanscrit Origin. The following is an extract of a letter recently addressed by a learned Bramin, named Radhakant Deb to the Committee of Correspondence of the Asiatic Society, and published in the "Literary Gazette."—"Having lately had occasion to refer to the Agni Purana, I found a passage therein, which convinced me, that the division of the day and night into twenty-four hours, from midnight to midnight, by Europeans, is of Sanscrit origin;—it is as follows:—"Two ghaticas make one muhurta, of which thirty form a day and night. Twenty-four belas are said to constitute a day and night. It is to be remarked, that the course of the muhurtas is invariably from sunrise, and that of the horas from midnight." The interpretaton of the above is this;—that thirty muhurtas are equal to a day and night, which two are comprised in twenty-four belas or horas; and that the computation of day and night by thirty muhurtas is from sunrise to sunrise; and that by twenty-four belas or horas, from midnight to midnight. Hence it appears, that the word *hour* is probably derived from the Sanscrit term hora, especially when the exact correspondence of the latter with the Greek and Latin *hora* is considered.

Animal Architecture.—The sagacity of the elephant, which in the eastern world is taught so many and such wonderful lessons, and the almost human ingenuity of the beaver, are almost surpassed by the smallest animalculæ, or polypi. What are our reflections, when we see the industrious architect of the many islands of the Indian Archipelago, daily raising *perpendicular* walls on the windward side, some hundred fathoms from the bottom; while on the leeward side they are formed in a promiscuous manner! In this we see a degree of intelligence almost beyond credibility. By this formation, the young are protected from the storms and washings of the waves, and repose in a state of security and prosperity. How interesting to contemplate an act of precaution, in an animal so simply formed, as to be taken for a species of vegetable, until within a few years! It may be called instinct; by any name it is wonderful and interesting.—*Correspondent Silliman's Journal.*

NEW PATENTS.

Wm. Marshall, of Huddersfield, shear manufacturer, for improvements in machinery for cutting or shearing, cropping, and finishing, cloth and other articles manufactured from wool or other raw materials.—26 April—2 months for enrolment.

Thomas Breid Euback, of Birmingham, merchant, for a machine, or improved mode of manufacturing tubes or rods, and for other purposes.—26 April—6 months.

James Griffen, of Witney Moor Works, near Dudley, scythe manufacturer, for an improvement in the manufacture of scythe backs, chaff knife backs, and hay knife backs.—26 April—6 months.

MINOR CORRESPONDENCE.

Chimney Sweeping Machines.—Sir,—Since reading your account of Glass's Improved Apparatus for Sweeping Chimneys, I have employed his men to sweep mine—which they did to my entire satisfaction; and it may be important to say that they charged no more than is usually charged for climbing boys. Those I had previously employed used the machine very reluctantly, and charged double. I would suggest, that if the Society would ascertain the residences of persons who will use Glass's machines, and sweep at the same prices, and expend their funds in advertising him and them, they would, I think, soon relieve many of the little slaves from their misery.—J S. S.

W. W. of Tyneside, will find the Portable Hand-Mill, about which he makes inquiry, described in Vol. iii. p. 169.

Wedgwood's Pyrometer.—Perhaps you (or, through the medium of your paper, some of your readers) can inform me where I can procure one of Wedgwood's Pyrometers (an instrument for measuring intense heat), which was invented about twenty years ago. I called at the house of Mr. Wedgwood, in York-street, St. James's-square, and find the present gentleman of that name is the son of the inventor, and that he (though he has many applications for them) has discontinued making them for some years. If they are not already manufactured for sale, perhaps some one of your ingenious readers will undertake such a task. A description of them will be found detailed in the article on "Heat," lately published by the Society for the Diffusion of Useful Knowledge, and which was the first intimation I had that there was such an instrument, which might prove of great utility to me, if I could procure one.—I am, Sir, &c. T. B.—Wedgwood's Pyrometer has been incautiously praised in the Treatise alluded to. It takes for its criterion the degree of contraction which pure clay undergoes when exposed to heat; but it so happens, that clay, subjected to an intense heat for a short time, contracts nearly as much as clay subjected to a lesser heat for a longer period. The use of this instrument has accordingly been long since abandoned; and that now generally preferred is Daniel's Pyrometer, which may (we believe) be obtained of any instrument maker. Thermometric beads, manufactured on the plan proposed by Mr. Prinsep (see Mechanics' Mag. No. 244, p. 208), will probably be found to answer still better than either.—Edit.

INTERIM NOTICES.

In going over the letters of our esteemed friend at Ennis, it seems to us that there must be one of the series missing. In a letter of the 24th of May, he speaks of the R. C. and the O. of the R. C., as matters he had previously written to us about; but we can find nothing concerning them, in any of his preceding letters, which are of the following dates; 16th May, 15th May, 9th May, 6th May, 30th April, 25th April, &c. We beg he will set us right on the subject, and continue to forward to us whatever occurs to him as worthy of communication.

We have again to regret the postponement of several articles for want of room.

Our Apiarian Correspondent, J. S. of Bath (Vol. vi. No. 146 and 147), will oblige a friend who is desirous of opening a direct communication with him, by applying at the Post-office, Bath, for a letter addressed to him.

Communications received from Isaac Dudley—F. F.—S. Penn, sen.—T. Dolley—Q. E. D.—J. E. D.—A Subscriber—James Harrison—Tyro—J. R.

☞ Mechanics' Magazine, Part 62, was published May 10; Part 63, June 7th; and Part 64, will be ready for the Magazine parcels, June 30th.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-Row, London.

Printed by G. Duckworth, 76, Fleet-street.

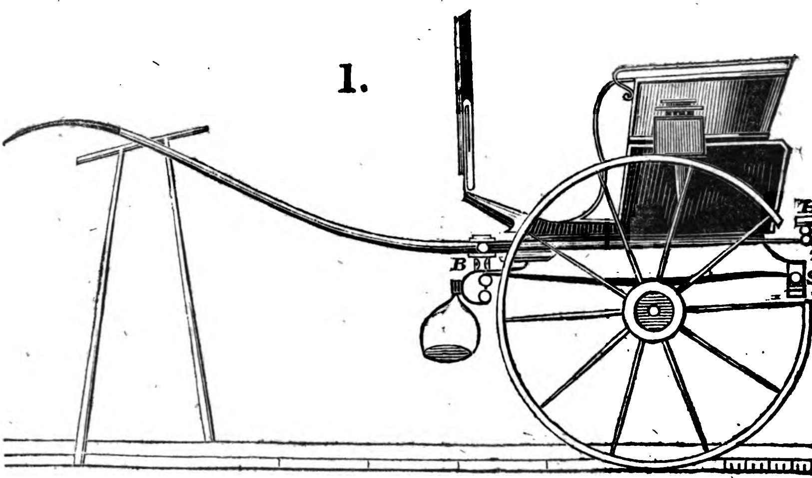
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 252.] SATURDAY, JUNE 14, 1828. [Price 3d.

FULLER'S IMPROVED STANHOPES AND PHAETONS.

1.



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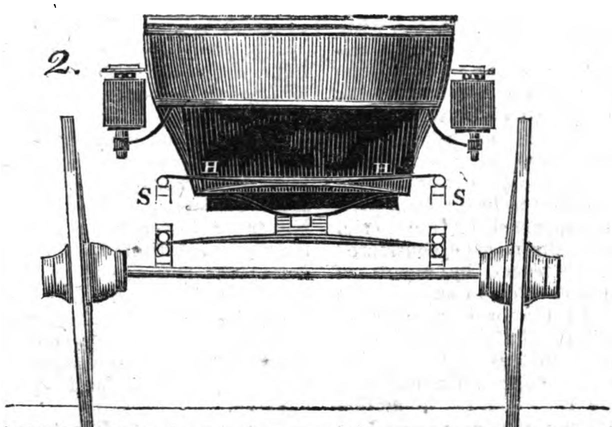


The following account of these improved vehicles we extract from an "Essay on Wheel Carriages," just published by the inventor, Mr. Fuller, and noticed in the Review Department of our present Number.

Improved Stanhope.—Two-wheeled carriages being partly supported, as well as drawn, by the horse, are thereby subjected to a motion arising from his action. Those carriages, which have the body parts constructed upon springs separate from the shafts, are less effected by this motion, as the vibration of the shafts is counteracted by the action of the springs; but there is much additional weight of iron work in carriages so

constructed, and the horse works to great disadvantage, as he is between shafts which are lined with iron and bolted upon the axle, that will not yield in the slightest degree to his action; he carries an unyielding weight upon his back, jarring with all the concussions of the roads.

If, on the other hand, the body be attached to the shafts, and the whole upon springs, the horse is relieved from the jarring, and the weight lessened upon his back by the elasticity of the springs, and the carriage itself rendered lighter; but then the rider is subjected to the motion arising from his action. If, therefore, the rider can be relieved from this unpleasant effect, the event will be to produce a more perfect two-wheeled carriage than has yet been constructed. This very desirable object, Mr. Fuller flatters himself he has accomplished, by the improvements of which he gives the following explanation:—

Fig. 1 (see prefixed engravings), represents a gig of the Stanhope form. The body is constructed upon three springs, and attached to the axle and wheel in the usual way. The machine in this state (*i. e.* without the shafts), is capable of supporting the whole of the weight to be carried, but without some further contrivance the weight would preponderate before or behind. In order, therefore, to preserve the carriage steady, a greater proportion of weight is placed to the front part, which is supported by the horse. Now, the shafts may be considered as two long levers, by means of which he is enabled to support this weight. In the ordinary way of attaching these shafts or levers, they are so connected as to form a part of the machine itself: the effect is, that when raised or set in motion by the action of the horse, the whole machine vibrates upon the axle, which may be called the fulcrum of this lever,—the consequence of which is very disagreeable to the rider, and has not been inaptly termed "knee motion." Mr. Fuller has contrived to attach his shafts to the front, or drawing bar, immediately under the foot board, and marked B, by means of shackles and centre pivots, upon which the shafts freely move. The shaft itself is made of lance wood; the hinder part from B being gradually tapered and lined with whalebone, is rendered elastic. The extremity is finished with a thin plate of iron, clipping the wood and whalebone, and forming an eye, which is received into the shackles S S, of the transverse hind spring H. This is rendered more evident by the back view of the carriage, fig. 2. Continuing to view the shafts as levers, we shall now find the fulcrum, or bearing point, is removed to these shackles and pivots upon the drawing bar B. Therefore, if the hinder parts of the shafts, and the transverse hind spring, to which they are attached, are made sufficiently elastic, these parts easily give way, as the front parts are raised or depressed by the motion of the horse,—the body itself remaining perfectly steady, and the rider entirely relieved. The horse is also greatly relieved, inasmuch as these shafts freely accommodate themselves to his action,—a circumstance of great moment in all situations, but particularly when going down hill. There are also the following additional advantages attending these shafts:—

They are easily disengaged from the gig, by withdrawing the pivots from the fulcrum joints; and others, more or less compressed, to suit higher or lower horses, can with facility be substituted,—thereby rendering the carriage suitable to any horse at pleasure: there is also equal facility in producing a curricle; or, by the addition of a pair of front wheels, and a driving seat, a very complete and well appointed phaeton.

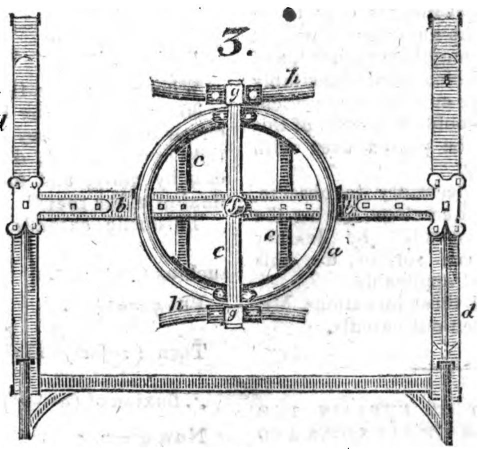
The Improved Phaeton.—The improvements here embodied, and which are equally applicable to all sorts of four-wheeled carriages, consist in the adaptation of an apparatus to the front part of a phaeton, so as to prevent the carriage from overturning, by preserving the body at all times in a horizontal position; even when one of the

wheels passes accidentally over a large stone in the road, or up a bank by the road side, or any other obstruction which would overthrow a carriage built upon any of the ordinary plans at present in use.

This invention is best adapted to those carriages which are constructed without perches. The greater number of phaetons, and the lighter descriptions of four-wheeled carriages, are of this class.

A circular horizontal locking wheel, formed of the usual materials, as represented in fig. 3, is affixed to the front part of the carriage. This wheel bears upon the axle part *b b*, and upon segments supported by arms *c c*, extending from the axletree bed, which are enabled to turn round, horizontally, upon these bearings in the act of locking; the axletree bed itself being attached to and supported by the front springs *d d*, which are connected to the front axle and wheels. A bar *e e* crosses the middle of the locking wheel, and is attached to it by ears and bolts; the centre of this bar having a circular hole through which a pin *f* passes for the purpose of forming the pivot or axle on which the before-mentioned axle-bed *b b*, &c. turns or locks round. The extremities of the bar *e*, which extend beyond the wheel, are made cylindrical; and to these are attached the plummer boxes, or gudgeons *g g*, from whence the bent arms *h h* extend, for the purpose of supporting

3.



the front part of the body of the carriage.

It will now be perceived, that in the event of one of the fore wheels running over a large stone, or any other elevated obstruction in the road, the axletree will be thrown out of its horizontal position; but the body of the carriage in front being supported solely upon the pivots at the end of the bar *e*, the plummer boxes *g g* will turn upon the pivots, and cause the bent arms *h h* to keep the body of the carriage in its erect position, although one of the fore wheels is raised up so considerably.

A carriage with this improvement will be found to possess the following advantages:—

1st. The weight being at all times equally distributed upon the four corners, each spring can only be required to support that portion of the load immediately over it; these parts may, therefore, be made proportionably lighter, and the vehicle altogether built of considerably less weight.

2d. The resistance in draught is much lessened, the horses having only to exert sufficient force in drawing over every opposing substance, one fourth, instead of one

half of the entire road; this advantage on uneven roads must be immense.

3d. The liability of the carriage to be overturned is much lessened; in fact, this circumstance is rendered impossible, as far as regards the front wheels, either of which may be raised any height without disturbing the equilibrium of the carriage body. The same advantage attends the hind wheels, though not to so great an extent; but it may be here remarked, the shock from a front wheel meeting an obstacle is much greater, and more likely to overturn the machine, than a similar concussion with the hind wheel.

A stage coach properly constructed, with this improvement adapted to it, would be found to possess very considerable advantages over those now in use. The number and weight of the springs might be reduced, and obstructions which would inevitably overthrow stage coaches as at present constructed, would, by means of this improvement, be passed over with perfect security.

It may be necessary to observe, that to *a perch* carriage, having the body part suspended by leather braces from cee springs, &c. this invention is not applicable.

For both of these inventions, Mr. Fuller has taken out patents.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(*Continued from p.* 315.)

35. But though tables of fluents have been constructed, it is usual and most convenient to deduce some general rule by which we can arrive at them without other assistance. All the problems which we have given might have been solved by such a rule, but we did not wish to refer to the Binomial Theorem till we had elucidated the principles which we are endeavouring to explain, by a few particular applications.

Suppose $y=ax^n$ and x to receive an increment h, which changes y to y_1; then

$$y_1=a.\overline{x+h}|^n=a.x^n+n.a.x^{n-1}h+n.\frac{n-1}{2}.a.x^{n-2}h^2+, \text{\&c.}$$

$$y_1-y=n.a\,x^{n-1}h+n.\frac{n-1}{2}.a.x^{n-2}h^2+, \text{\&c.; and}$$

$$\frac{y_1-y}{h}=n.a\,x^{n-1}+n.\frac{n-1}{2}.a.x^{n-2}.h+, \text{\&c.;}$$ whence, by diminishing h, we have the limit of $\frac{y_1-y}{h}=n.a\,x^{n-1}$;

and $\frac{y_1-y}{h}$ being the limit to $\frac{\dot y}{\dot x}$, as before, we have $\dot y=n\,a\,x^{n-1}\dot x$.

Similarly, if

$$y=a\,x^{\frac{n}{m}}\quad \dot y=\frac{n}{m}.a\,x^{\frac{n}{m}-1}\dot x.$$

Whence we have this Rule:—

36. "To find the fluxion of the power or root of any variable, multiply by the index, diminish the index by unity, and multiply by the fluxion of the root."

This rule extends to quantities such as $(a^n+x^n)^{\frac{p}{q}}$.

Put $y=a^n+x^n$.

Then $(a^n+x^n)^{\frac{p}{q}}=y^{\frac{p}{q}}$.

$\therefore$ fluxion of $(a^n+x^n)^{\frac{p}{q}}=\frac{p}{q}.y^{\frac{p}{q}-1}\dot y$

Now $\dot y=n.x^{n-1}\dot x$ since $y=a^n+x^n$*

and $y^{\frac{p}{q}-1}=(a^n+x^n)^{\frac{p}{q}-1}$.

Hence, $\frac{p}{q}.y^{\frac{p}{q}-1}\dot y=\frac{p}{q}.(a^n+x^n)^{\frac{p}{q}-1}.n.x^{n-1}\dot x$ or the fluxion of

$$(a^n+x^n)^{\frac{p}{q}}=\frac{np}{q}.(a^n+x^n)^{\frac{p}{q}-1}x^{n-1}\dot x$$

By this rule also we shall find that the fluxion of $\overline{\frac{a\,x+b}{c}}|^{\frac{3}{2}}=\frac{3}{2}.\sqrt{\frac{a\,x+b}{c}}.\dot x$

---

* a^n being constant, has no fluxion, as will be more fully explained hereafter.

37. We remarked before, that fluents were obtained by reversing the steps which we took to obtain the fluxions: hence the converse of the last rule will furnish us with a general method for obtaining fluents, which will be as follows:—"Increase the index by unity, divide by the index so increased, and by the fluxion of the root."

Thus $n. x^{n-1} \dot{x}$ by increasing the index, becomes $n. x^n. \dot{x}$; and dividing by this index, we obtain $x^n. \dot{x}$; and, again, by the fluxion of the root x, we arrive at last at the fluent x^n.

Similarly, had the quantity been $\overline{a+x}|^n \dot{x}$ we should, by applying the rule, obtain the fluent $\frac{\overline{a+x}|^{n+1}}{n+1}$.

The fluent of $\frac{\overline{9.y+4.a}|^{\frac{1}{2}}}{27.a^{\frac{1}{2}}} \times \dot{y} = \frac{\overline{9.y+4.a}|^{\frac{3}{2}}}{27.a^{\frac{1}{2}}}$.

38. These two rules for finding fluxions and fluents are applicable only to very simple cases. Many ingenious artifices are resorted to for obtaining fluents, involving very abstruse analytical considerations. Our purpose being merely to explain the first principles of the subject, we shall not extend our inquiries any deeper, but will proceed to mention some restrictions with which we must understand what has been said respecting fluents.

39. A fluxion has been defined to be the velocity with which a quantity increases or decreases; whence it follows, that as a constant quantity neither increases or decreases, it can have no fluxion. Suppose we take the fluxion of the sum of a constant and a variable quantity, it will be the same as the fluxion of the variable alone. Thus the fluxion of $a^n+x^n = o+4. x^{n-1} =$ fluxion of x^n.

Hence it is manifest that the assertion we made before, that the quantities whose fluxions are equal are themselves equal, requires some modification; for perhaps there may have been some constant quantities in the original fluent, of which the fluxion obtained from it gives no indication.

This will be best understood by an example.

In the instance which we gave of the solid contents of the paraboloid, we measured the abscissa from the point A, in which the curve cuts the axis, and therefore we made use of equation (B) $y^2=4\,a\,x$. Suppose it were necessary to use equation A. $y^2=4\,a\,x-4\,a^2$, where we measure from the directrix.

We should have $c\,y^2.\dot{x}=4\,c\,a\,x.\dot{x}-4\,c\,a^2\,\dot{x}$ and the fluent would be $2\,c\,a\,x^2-4\,c\,a^2\,x$; but as there may have been a constant quantity in the fluent from which the fluxion was obtained, let us add a constant quantity C.

Then the paraboloid $=2\,c\,a\,x^2-4\,c\,a^2\,x+C$.

It remains to determine the value of C, if, indeed, it have any value at all.

It appears, since x is measured from the directrix, that the solid does not begin till x is greater than a (that is, O A).

Hence, if $x=a$, the expression $2\,c\,a\,x^2-4\,c\,a^2\,x+C$, which then becomes $2.c\,a^3-4\,c\,a^3+.C$, vanishes, and we have,

$$2\,c\,a^3-4\,c\,a^3+C=o$$
$$\therefore\ C=2\,c\,a^3.$$

Hence the solid contents of a paraboloid, whose length of axis is $x=2\,c\,a\,x^2-4\,c\,a^2\,x+2\,c\,a^3$.

Suppose $a=2$ feet, and $x=5$; then the contents.

$$=c.\left\{2+2\times25-80+2\times8\right\}$$
$$=113.09724 \text{ cubic feet.}$$

Had we omitted the constant quantity C, we should have had 62.83180 for the solid, and thus we should have made an error of 50.26544 cubic feet.

We will now find the length of the curve whose equation is $y^3=a\,x^2$, or $x=\frac{y^{\frac{3}{2}}}{a^{\frac{1}{2}}}$

By our first rule, $\dot{x}=\frac{3\,y^{\frac{1}{2}}\,\dot{y}}{2\,a^{\frac{1}{2}}}$,

and $\dot{x}^2 = \frac{g\cdot y\cdot \dot{y}^2}{4\,a}$ ∴ $\dot{x}^2 + \dot{y}^2 =$ $\left(\frac{g\cdot y}{4\,a}+1\right)\cdot\dot{y}^2 = \frac{g\cdot y+4\,a}{4\,a}\cdot\dot{y}^2$ ∴ $\sqrt{\dot{x}^2+\dot{y}^2}$ or the fluxion of the curve $= \sqrt{\frac{9.\,y+4\,a}{4\,a}}\cdot\dot{y}$.

Now the fluent of this is, by our second rule, $= \frac{\overline{9\,y+4\,a}^{\frac{3}{2}}}{27.\,a^{\frac{1}{2}}}$ and adding the constant, we have the length of the curve $= \frac{\overline{9.\,y+4\,a}^{\frac{3}{2}}}{27.\,a^{\frac{1}{2}}} + C$.

If $y = o$, the curve (whose magnitude depends on y), $= o$ also.

Hence, $\frac{\overline{4\,a}^{\frac{3}{2}}}{27.\,a^{\frac{1}{2}}} + C = o$, and

$C = -\frac{8\,a}{27}$.

Hence the curve $\frac{(9.\,y+4\,a)}{27.\,a^{\frac{1}{2}}} - \frac{8\,a}{27}$.

(*To be continued.*)

FORMULÆ FOR THE REDUCTION OF THE DIFFERENT KINDS OF TIME.

Sir,—The following formulæ respecting time, though at first taken from "Kelly's Spherics," have received considerable alterations; and, in point of arrangement, &c. they will, it is believed, be found more satisfactory than any that have hitherto been published:—

Let M = mean time; A = apparent time; S = sidereal time.

E = equation of time at apparent noon; e = daily variation of that equation.

R = sun's true right ascension, in time, at apparent noon; r = daily increase of R.

N = sun's mean right ascension, or mean longitude, in time, at mean noon; that is, the sidereal time at mean noon.

m = ·0027304 = 3′ 55·91″ divided by 24 hours = the factor for reducing sidereal to mean time, at the rate of 3′ 55·91″ for 24 hours of sidereal time.

s = ·0027378 = 3′ 56·55″, divided by 24 hours, = the factor for reducing mean to sidereal time, at the rate of 3′ 56·55″ for 24 hours of mean time.

t = 24 hours, taken in the same denomination as the numerator of the fraction in which it is found.

The following six are all the cases that can occur.

Case 1.—To reduce *apparent* to *mean* time.

$$M = A + E \pm \frac{A\,e}{t}.$$

Case 2.—To reduce *mean* to *apparent* time.

$$A = M \mp E \mp \frac{\overline{M \mp E}\,.\,e}{t \mp e}.$$

Case 3.—To reduce *sidereal* to *mean* time.

$$M = S - R - \overline{S - R}\,.\,m \pm E;$$

or,

$$M = S - N - \overline{S - N}\,.\,m.$$

Case 4.—To reduce *mean* to *sidereal* time.

$$S = M \mp E + \overline{M \mp E}\,.\,s + R;$$

or,

$$S = M + M\,s + N.$$

Case 5.—To reduce *sidereal* to *apparent* time.

$$A = S - R - \frac{\overline{S - R}\,.\,r}{t + r}.$$

Case 6.—To reduce *apparent* to *sidereal* time.

$$S = A + \frac{A\,r}{t} + R.$$

N.B. The *upper* signs of E are to be used when mean time *exceeds* apparent, and the *lower* signs when mean time is *less* than apparent. And the proper sign of e is like or unlike that of E, according as E is increasing or decreasing; but the sign of the e in the denominator of Case 2, is + or —, according as the solar day is *more* or *less* than 24 hours.

$N = R \mp E \mp E\,s$; hence, N may be obtained from R, or otherwise from the solar Tables of mean longitude.

To save the trouble of proportion-

-ing with m and s, the following Tables will be found very convenient; and although extremely concise, will fully answer the purpose: the arrangement being such that the proportionate parts for any time can be readily obtained.

TABLE I.—*For the Reduction of Mean to Sidereal Time.*

Mean Time.	*Reduction.*			*Mean Time.*	*Reduction.*	
ho.	m.	s.	dec.	m.	s.	dec.
1		9	86	1	0	16
2		19	71	10	1	64
3		29	57	20	3	29
4		39	43	30	4	93
8	1	18	85	40	6	57
16	2	37	70	50	8	21

TABLE II.—*For the Reduction of Sidereal to Mean Time.*

Sid. Time.	*Reduction.*			*Sid. Time.*	*Reduction.*	
ho.	m.	s.	dec.	m.	s.	dec.
1		9	83	1	0	16
2		19	66	10	1	64
3		29	49	20	3	28
4		39	32	30	4	91
8	1	18	64	40	6	55
16	2	37	27	50	8	19

These Theorems and Tables cannot fail of being understood by all such as are conversant in practical and nautical astronomy.

I am, Sir,

Yours, &c.

VECTIS.

REMARKS ON THE REV. DR. EVANS'S ALGEBRAICAL PROBLEM.

Sir,—In No. 223, page 317, of your valuable Magazine, you inform us that the Rev. Dr. Evans, in his last sickness, amused himself with the following problem, but while in the midst of it experienced a relapse, which terminated his valuable existence:—

"Given, $x^2y+xy^2=a$
and $x^2+y^2=b$
To be solved by a quadratic equation."

In a subsequent Number (226, page 364), we are informed, "That the mathematical question by the solution of which Mr. Evans soothed one of the latest hours of his life, was somewhat erroneously given in our Number 223, page 317. It was not to be solved *by*, but *without*, a quadratic equation; the difference, it will be seen, is of material importance, as the working of it by a quadratic considerably abridges the difficulty of the task."

It does not appear that Mr. Evans effected a solution of the above problem, either *by* or *without* a quadratic equation. Had he, indeed, effected a general solution of the above problem, he would have made a most brilliant discovery: he would, in fact, have done that which has hitherto baffled the united efforts of the most celebrated mathematicians in the world; that is, he would have found out a general solution for the *irreducible case of Cardan's Rule.* This may be easily shown.

Since $x^2y+xy^2=xy(x+y)=a$; assume $x+y=s$, and $xy=p$; then $sp=a$, and $p=\frac{a}{s}$. Also $x^2+2xy+y^2=s^2$, or $x^2+y^2=s^2-2xy=s^2-2p=b\,.\,\cdot\,.\,p=\frac{s^2-b}{2}$; hence, $\frac{s^2-b}{2}=\frac{a}{s}$; from which $s^3-bs-2a=0$; a cubic equation, where the value of s can only be obtained in general terms of a and b, by a quadratic, when $a^2 \,7\, \frac{b^3}{27}$. For when $a^2 \angle \frac{b^3}{27}$, the equation $s^3-bs-2a=0$, falls under the irreducible case of Cardan's Rule. Another cubic equation may be found in terms of a, b, and p. For since $s=\frac{a}{p}$, and $s^2=b+2p\,.\cdot.\,b+2p=\frac{a^2}{p^2}$, or $p^3+\frac{b}{2}p^2-\frac{a^2}{2}=0$; and it might be easily demonstrated, that when this equation, $s^3-bs-2a=0$ falls under the irreducible case of Cardan's Rule, the cubic equation $p^3+\frac{b}{2}p^2-\frac{a^2}{2}=$

0, also belongs to the irreducible case.

In conclusion, Mr. Editor, allow me to state, that if Mr. Evans could have found general values of x and y from his two given equations, supposing $a^2 \angle \frac{b^3}{27}$, general values of s and p might be obtained from the dependant cubic equations, $s^3 - b\,s - 2\,a = 0$, or $p^3 + \frac{b}{2}\,p^2 - \frac{a^2}{2} = 0$; or, in other words, a general solution might be obtained for the irreducible case of *Cardan's Rule*.

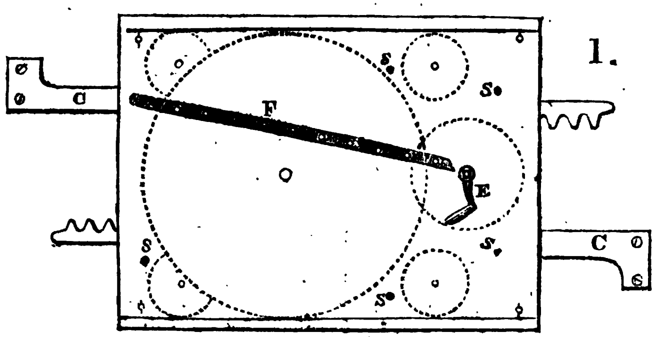
I am, Sir,

Yours, with respect,

G. S.

PORTABLE CRAMP FOR DRAWING TOGETHER JOINERY, FRAME-WORK, &c.

1.



Sir,—I send you herewith the model of a small instrument which I have devised for drawing together and tightening any sort of frame-work, or for compressing wood and other substances into a small bulk.

I am not familiar with the technical terms of the different parts of machinery; but, with the help of the model, and the following explanations, I think you will have no difficulty in making your readers acquainted (if you see proper) with the principle and details of its construction. An instrument of this description might also be employed as a jack for raising weights, &c. by merely turning the winch the contrary way.

Should this instrument be thought worthy of adoption in practice, and any one think fit to manufacture it for sale, all that the inventor will expect in return will be a single specimen of the article in its finished state.

I am, Sir,

Yours, &c.

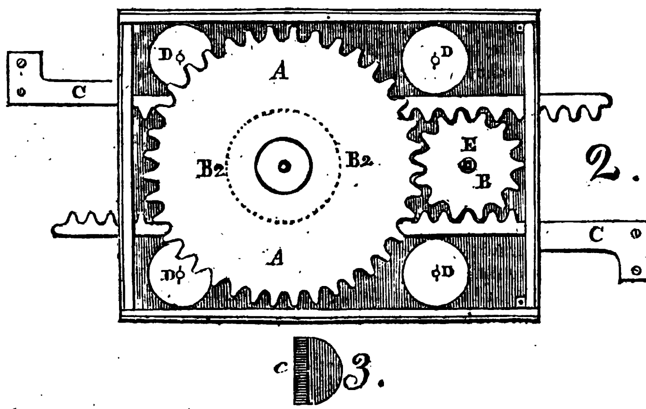
P. C.

The following is a description of the instrument, drawn up from the model, and explanations furnished by our correspondent:—

Fig. 1 is a front elevation of the instrument in its complete state; consisting of a box of a nearly square form, and about two inches deep, and enclosing the machinery, which is more fully exposed to view in fig. 2. A A and B are two toothed wheels working into each other. Beneath A, and attached to it, there is a third wheel (indicated by the dotted circle B 2) of the same size as B, and toothed also. C C are two racks, or arms, which go horizontally through the box, having teeth which work into the wheel B 2; the one on the upper, and the other on the lower side. D D D D are friction rollers, to facilitate the action of the racks C C. E the shaft of the wheel B, and winch adapted to it, of eight to ten inches purchase; to each of the racks C C there is attached, at opposite ends, a semicircular clamp, as represented by the end view, fig. 3. The mode

in which this apparatus works will be immediately apparent. The racks C C are drawn out till their clamps embrace the article to be drawn together, or compressed; the wheel B is then turned by the winch E, the wheel A A by B, and the wheel B 2 by A, while the opposite ends of the two racks are, by the action of B 2, brought together with immense power.*

As it may be necessary, when the cramp is brought to the pitch required, to keep it for some time at that pitch, there is affixed to the outside of the box, by a moveable pin, a shifting slip of copper F, with a hooked end, for the purpose of slipping over the winch, and preventing it from giving way. There are small holes *s s s s s* in the upper lid of the box, and holes also in the



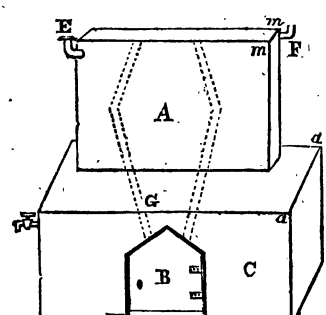
slip of copper, at the distance of every quarter of an inch, so that, by the help of the moveable pin, the slip of copper, or catch, may be applied in every possible situation.

The inventor recommends that the frame should be of iron, and screw-bolted together; that the bolts should be as flush as possible with the frame; and that the whole of the internal work should be exactly fitted, well tempered, and polished. The strength of the apparatus will, of course, be according to its size.

HOT WATER STOVE.

Sir,—At page 336, vol. viii. of your valuable Magazine, "C. R." wishes to hear or know of some substitute for the common grate, to be used in heating bed-rooms. As I have lately been engaged in manufacturing such a substitute, I hasten to give your correspondent, and others, a description and drawing of a stove for that purpose.

A is the body of a copper stove, hollow within, 6 inches in depth at *m m*, and 12 inches deep at *a a*,—there being a projecting shelf G all round, of 6 inches, for the reception of plates, glasses, &c. intended to be kept warm. The length at bottom is



3 feet, and from *a* to *m*, at the top,

* The wheel B does not, it will be observed, work into the racks C C (as may appear at first sight from the engraving), but only the wheel B 2.

3 feet,—the projecting shelf being about half way up. The whole being 3 feet square, is intended to fit into the recess usually built for grates. B is an iron door, with frame and grate to match,—the back stopped up; the dotted lines represent two flues running through the inside of the stove, and going out at the back (within three or four inches of the top), into the chimney; D is a cock to draw from; E is a small tube from which the stove is filled with water; F is a valve leading into the chimney. The whole is made of sheet copper, the front planished (with the exception of the door and grate, which are all iron); and being soldered water-tight, it is filled with water, and will contain perhaps 40 gallons. A coal fire is then introduced into the grate, and the door being well made, and shutting close, prevents the return of the least particle of smoke; and no air being admitted but through the ash-pan H, it soon heats the water up to the boiling point, 212°. The small quantity of coals may then be left, and not stirred; and the fire going out, the water will remain warm, and diffuse a very sensible heat at the end of twelve or sixteen hours, and thereby produce sufficient heat for the room through the night, without any unpleasant sulphureous smell or smoke. I have lit a fire in an apparatus of the above dimensions, at three o'clock in the afternoon; the water has boiled at four o'clock; and at ten o'clock the next morning the water was warm, although in the open air. The cock is intended to supply warm water at any time in the night; which to invalids is a most convenient thing. The expense of an apparatus of the above size is from 4*l.* to 5*l.*

I am, Sir,
Yours, &c.
RICHD. EVANS.

Swansea.

PRESERVATION OF STUCCO FRONTS.

Sir,—Having frequently observed inquiries from correspondents for the best means of prevention and cure of the damp in walls and stucco fronts; for the information of your numerous readers, I beg to transmit you the result of some trials I have made towards attaining that desired object.

Various suggestions have already been given in your invaluable Magazine; and among others, that of Messieurs D'Arcet and Thenard, of Paris, which was successfully tried upon the cupola of the church of St. Genevieve, in that city. On trying this, I found Roman cement would not stand that sufficient degree of heat (as it chipped off, with a detonating report, at a temperature of 137°), to admit of a complete saturation, independent of the expense and slowness of the process, and almost impossibility of applying it to the fronts of houses, especially in great thoroughfares.

I also tried washing with a strong solution of sulphuric acid; but, after a short period of wet weather, the green began to accumulate as before.

Towards the close of last year, I applied the following, viz.—120 parts salt, 54 soda, and 54 arsenic; these I dissolved in water, say salt to every 100lb., 35 water; the soda and arsenic in 27 water. With this I washed down the front, and, after a couple of days, painted it with two coats of Cook's Anticorrosion—(recommended by an "Amateur Mechanic," in answer to "Senex's" inquiry, page 104, vol. viii. of your Magazine). Cook's Anticorrosion, I found, was still to be obtained of Mr. Golding, 5, Great Winchester-street, Old Broad-street, whose father was the managing partner of Cook, the inventor, and has greatly improved upon the original recipe. Of him I had a cask of stone colour. Notwithstanding the heavy and continued rains during the winter, and the exposed situation of my premises, no symptom of damp has yet appeared, or tendency to vegetation.

I am, Sir,
Yours, &c.
W. W. T.

London,
May 15, 1828.

FAMILIAR ILLUSTRATION OF THE THEORY OF HARMONICS.

Sir,—A correspondent inquires, at page 149 of the present volume, for the easiest mechanical method of convincing a "learner," who has not acquired mathematical knowledge, that a string, of a given length and tension, which, when divided into equal portions, gives out an acute sound an octave higher, will vibrate twice as fast.

I know of no method of demonstrating the Theory of Harmonics so simple as by means of the Æolian harp; an instrument easy of construction, and generally well known, but which I shall describe for the benefit of such of your readers as may be unacquainted with it. It consists of a box of fine-grained deal, 1-8th of an inch thick, 2 feet 6 inches long, 5 inches deep, and 4 or 5 broad. On the top, or belly, is a round or other shaped hole, about 2 inches diameter; from end to end, both of which are of oak or beach, are stretched 4, 5, 6, 7, or 8 strings, fastened on pins at one end, and wound round pegs at the other, to tune them, which should be done in the following manner:—The outside, or largest strings, should be tuned to E or F below gamut, and the middle, or smaller, an octave higher. When tuned, the instrument is placed in a window sill, with the sash so shut down on it as to make a current of air on the strings, which, as the wind rises, will give out most pleasing gradations of sound, generally in the following order (but frequently separate and alone);—first, the octave, then its fifth; next, the double octave, then its third and the flat seventh; and if the draught of air be strong, all the series of intervals of the scale will be heard in succession, and blended together in the most beautiful combinations. Now, it ought to be explained to a "learner," that the intervals of the scale are to be produced by dividing a single string, or monochord, into arithmetical proportional parts, as follow:—

The open string, or generator, say C.

½	produces its octave	....	C above.
1-3d	——	its twelfth	G above.
1-4th	——	its fifteenth	C double octave.
1-5th	——	its seventeenth........	E above.
1-6th	——	its nineteenth	G above.
1-7th	——	its twenty-first........	B flat above.
1-8th	——	its twenty-second	C treble octave.
1-9th	——	its twenty-third	D above.

and so on, *ad infinitum*, till all the intervals, with their duplicates, replicates, &c. are formed, save and excepting only the sharp seventh of our scale, which, it seems, is not to be had by an aliquot or proportional division, but only by a compound fraction, reducible to 1-15th nearly; nor is it produced perfect in any tube, such as the horn, trumpet, trombone, &c. but by artificial means.

From hence it follows, that as we know a pendulum of a given length will oscillate in the same time, whether it describe a large or a small arc, so the vibration A B, when transferred to a portion C D, E F, or G H, must accelerate in a corresponding ratio with the diminution;

and that, therefore, when we hear from the undivided strings of the Æolian harp, or the harmonics of the lower bass notes of a piano,* all the sounds of the divided string, only *such parts* of those strings are in motion as (according to the divided string) produce those intervals, and

* The reasons why we usually hear the harmonics, the octave, the twelfth, and the seventeenth, and not the intermediate gradations, are very clearly ex-

that *they* consequently vacillate with a proportional rapidity.

I am, your old Subscriber,
G. J. G.

Rugby.

P. S. Your correspondent also asks, what wood is best calculated to hold the rest pins of the piano, so that it may keep in tune? Beech is usually employed by the best makers—Broadwood, Tomkinson, Stodart, and others; but as *all* woods will wear unequally, a little chalk in the hole will hold a pin, if that, or only a few are worn. The increased size of the rest pins in modern pianos is a great improvement, as is also the new method of bracing. Permit me, before I conclude, to observe, in answer to another correspondent, "Philo Musicus," that I am afraid his stereotyping of violins is impracticable, as wood, and that only of particular sorts, will answer for musical instruments. It is, I believe, a fact, that some of the best violin and violoncello makers of the present day cannot make two instruments, though exactly alike in materials, form, &c. produce equally good tone. I once heard a sailor in the streets playing a tin fiddle, and I assure you it mended my pace.

NEW AND OLD STYLES.

Sir,—In answer to the query of your correspondent, J. P. Grellet,—"Suppose a person born on the 3d of February, 1751, O. S., what will be his age on the 14th of February 1828?"—it does not admit of a doubt, I apprehend, that the person alluded to completed his 76th (not his 77th) year on the last-mentioned day. This is obvious, on considering that the alteration of the style, in 1752, did not consist merely in deducting eleven days from that year, by calling the 3d of September the 14th; but it also made that year, and every succeeding year, terminate on the 31st of December, instead of the 24th of March (as was previously the case): consequently, the day which would have been called February 3, 1753, if no alteration in the style had taken place, became February 14, 1754, ascending to the new style; and, of course, February 14, 1828, would have been February 3, 1827.

As your widely-circulated publication may sometimes fall into the hands of young lawyers, I take this opportunity of noticing how very frequently the alteration in the style is disregarded in preparing abstracts of title. For instance, if two deeds are to be abstracted, one dated in January 1748, and the other in December of the same year, the former is erroneously treated as the earlier deed, and takes precedence in the abstract, accordingly. No doubt the young gentlemen who make these mistakes must be often surprised at finding wills proved in the months of January, February, and March, when the testators died in the month of April, or some subsequent month, of the same year.

I am, Sir,
Yours, &c.
A MEMBER OF GRAY'S INN.

May 24, 1828.

plained by Bernoulli, and by Chladni (Traité d'Acoustic); and since more fully by Chorou; to whom those pursuing this interesting inquiry may refer, as this letter is not intended for a Treatise on Acoustics, but merely a detail of a mechanical experiment.

NEW PUBLICATIONS

Connected with the Arts and Sciences.

An Essay on Wheel Carriages, containing a consise View of their Origin, and a Description of the variety now in use, with comparative Observations on the Safety of those upon Two and Four Wheels; and Remarks on the dangerous Construction of the present Stage Coaches. To which are added, Observations on the Mechanical Power and Operation of Wheels, &c. &c. By T. FULLER, Coach-builder, Bath. 83 pp. 8vo. With seven plates. Longman and Co.

The Essay before us is the production of a very sensible and ingenious coach-builder, who, disclaiming all pretensions to fine writing, and discarding technical

language as unsuitable for general readers, has made it his aim to convey to the public, in a plain and familiar style, "a knowledge of the construction, and most useful appropriation of the variety of carriages now in use." We cannot promise that it will, in point of comprehensiveness, answer those expectations which a perusal of the title is calculated to excite, for the historical part of the affair is extremely meagre, and the merits of Mr. Fuller's own improvements (described in a preceding part of our present Number) are dwelt upon too much to the prejudice of the improvements of others; but so far as it goes, it will be found well worthy of being consulted by every person interested in the proper construction of wheel carriages. To the working coach-builder it will be particularly useful, from the excellent plan which the author has adopted of giving all his drawings to a correct scale. In these drawings are comprehended designs for coaches and chariots, landaus and landaulets, barouches and barouchets, britskas, phaetons, curricles, cabriolets, tilburies, Stanhopes, &c.; and, to ascertain the certain proportions of each in actual construction, the builder has only to refer with a common pair of dividers to the scale at the foot of each plate.

Of the great variety of carriages noticed by Mr. Fuller, he considers the phaeton as the only one of "a decided character," that is of "English origin." He forgets, surely, the *mail coach*, for which England, beyond every other country in the world, is celebrated. In afterwards treating of this sort of carriage, he affirms that "not *one* step have these machines advanced towards improvement for the last forty years past." He adds, that "by improvement," is here to be understood, "approaches towards safety." Even in this qualified sense, however, we consider this dictum of Mr. Fuller's as by no means warranted. There have, of late years, been many improvements, not only proposed, but adopted in practice, which have nothing else for their object but *safety*; and some of these it would have been no more than fair in Mr. F. to have noticed. On the subject of *short perches*, respecting which stage coach masters remain most obstinately in error, Mr. F. refers to the following simple experiment for evidence of their inutility.

"Now, with respect to the other presumed advantage—that of short perches; the fallacy of this opinion might be shown by making a few experiments with a common timber carriage, drawn by a weight running over the roller of a well. First, let the hind wheels be brought close to the front ones, and attach sufficient weight to the end of a rope as will draw the carriage; next, remove the wheels as far back as the perch of the timber carriage will allow, and repeat the experiment, and it will be found that the same weight will draw the carriage as before;"—showing, clearly, that a carriage is drawn quite as well with a long as with a short perch, while all the risks attending the latter are avoided.

That accidents frequently arise from the sort of horse employed, and not from any fault in the construction of vehicles themselves, is a fact but too generally overlooked; the following observations on this subject (scattered through the work, but here brought together) are deserving of attention.

"Much more is depending upon the horse in a two-wheel than in a four-wheel carriage; more care, therefore, is required in suiting the horse to the carriage; his height in particular should be regulated by that of the carriage he is required to draw."

"The Stanhope and the Tilbury require fine actioned horses, with plenty of bone, about fifteen hands two inches high. With a Stanhope, a lower and more compact horse is sometimes used; but when speaking of a Tilbury horse, the description of animal first mentioned would be understood."

"The idea of two-wheel carriages being unsafe, has lately gained much ground in public opinion; but when we consider the extensive use of these carriages, the improper horses so often applied to them, and the unskilful or inexperienced hand which so frequently undertakes to direct them, it is only surprising we do not hear of more accidents. That there is more security in a carriage upon four wheels, cannot be denied; but this security has been much over-rated, as it applies to their being used with one horse. If a spirited horse, such as are generally driven in Tilburies or Stanhopes, were put to some of these four-wheel carriages, it is doubtful whether any additional security would be gained. The slightest defect in the construction or operation of the carriage would produce serious consequences, as such an animal would be too quick in his movements to submit to sudden check or violence."

"There is a description of horse much used in the West of England, from

fourteen and a half to fifteen hands high, and worth about 35*l*. Some of these horses, though they look well from good keep and grooming, are heavy in the shoulders, and not calculated for quick travelling. If a horse of this sort be drove in a Tilbury or Stanhope, in the event of a stumble (which is very likely to occur) he must fall; and as the front part of the carriage descends with him, the riders are necessarily thrown out. The fault is then attributed to the carriage, when it more justly appertains to the horse; and if such an animal were driven in a four-wheel carriage, the riders would have remained steady during a similar fall, and thus escaping injury, the occurrence would not be called an accident. For horses of this description, it is scarcely necessary to observe, a carriage with four wheels is best suitable."

The author has, by way of conclusion, a chapter on the general subject of wheels and axles, but we cannot say much in favour of the scientific ability which it displays. Mr. F. speaks disparagingly of high wheels, cylindrical wheels and axles, and broad tires, while nearly every eminent man of science, who has hitherto treated of them, has recommended them strongly. He states his views, however, with modesty, and though erroneous, we think, in his general conclusions, must be allowed, in one or two subordinate points, to have the advantage of his more scientific antagonists.

LONDON MECHANICS' INSTITUTION ANNIVERSARY.

The Anniversary of the foundation of this Institution was celebrated by a Public Dinner at the Freemasons' Tavern, on Thursday, the 6th of June. Doctor Birkbeck in the Chair.

His Royal Highness the Duke of Sussex, who was expected to preside on the occasion, was prevented from attending by indisposition; but the company were honoured by the presence of Mr. Brougham, the Hon. James Abercromby, M. P., Mr. Hobhouse, M. P., and several other eminent individuals.

The first toast given, after the cloth was removed, was—"Prosperity to the London Mechanics' Institution."

Mr. Brougham then proposed the health of "the Founder of their great, flourishing, and, he hoped, perpetual Institution—Dr. Birkbeck."

Dr. B. expressed his grateful sense of the compliment paid to him; and, after explaining the reasons "which had induced him to establish the Institution," gave the health of "Henry Brougham, the firm, consistent, and enlightened friend of Universal Education."

Mr. Brougham, in returning thanks, took the opportunity of toasting another friend of his, of whom they had no doubt all heard, and to whose efforts, beyond those of all other men, mankind were likely to be deeply indebted, namely—"The Schoolmaster."

The healths of Mr. Abercromby and Mr. Hobhouse were next drank, and gave occasion to eloquent speeches from both these gentlemen.

The company finally toasted the health of Dr. Fellowes (not present, it would seem), whose two prizes for the past year were stated to have been awarded as follows:—

The first, of £10, to a Mr. Kingsnorth, a hinge-maker, for a Treatise on the Lever; and the second to Mr. G. Ewings, carpenter, for the invention of a Press, in which the use of screws is superseded by a combination of levers and wedges.

There has been also a third prize given (the gift, we believe, of the Vice-Presidents), of a silver medal, to a Mr. Braund, cabinet-maker, for a well-executed Drawing of Machinery.

☞ To the preceding account, which we have gathered from the public papers, we feel ourselves imperatively called upon to add a few words of remark. Mr. Brougham, it will be observed, gave the health of Dr. Birkbeck, as "*the founder* of this great, flourishing, and, he hoped, perpetual Institution;" and Dr. Birkbeck did not disavow his claim to be considered in that character.

We shall not trust ourselves to give expression to the feelings which the pretensions thus set up have excited, but simply recall to the notice of our readers what both Mr. Brougham and Dr. Birkbeck have themselves said on former occasions, and leave every impartial mind to judge for itself, how far they have done fairly on the present.

In an article on the progress of Mechanics' Institutions, published in the "Edinburgh Review" for Oct. 1825, which has been universally ascribed to Mr. Brougham, and bears internal evidence of proceeding from the same pen as the "Practical Observations,"(being, in fact, a sequel to that publication, which appeared originally in the form of an article in the same Journal,) there

occurs the following passage in reference to the London Mechanics' Institution:—"The foundation of the Theatre was laid about Christmas, and on the 8th of July it was completed and opened by the distinguished founder, Dr. Birkbeck." But, lest it should be supposed that it was meant by this to designate Dr. B. as the founder of the *Institution*, the writer afterwards adds,—"We have called Dr. Birkbeck the founder *of this building* (the Theatre)—and well we may; for he advanced the money (several thousand pounds) which purchased the house and erected the Theatre." Will Mr. Brougham, then, explain how it happens that the gentleman who, in 1825, he described as being merely the founder of the *Theatre*, and on the ground merely of his having advanced the money to build it (on the security, it should have been added, of the building, and at four and a half per cent. interest), has been toasted, in 1828, by him, as the founder of *the Institution?* Can the lapse of two or three years have changed a matter of fact, or extinguished entirely the personal knowledge which Mr. Brougham once possessed of all the circumstances attending the foundation of the Institution?

So much for the eulogist; now for the eulogized. In Doctor Birkbeck's inaugural address to the members of the Institution, on the 20th Feb. 1824, and a copy of which inaugural address, be it remembered, is deposited in the foundation stone of that theatre, the founding of which by Dr. B. has been so strangely converted into a founding of the Institution itself, he used these words—

"For myself, WHO ALTHOUGH NOT THE ORIGINATOR OF THIS INSTITUTION, took the earliest counsel with its *earliest effectual projectors*, I can boldly declare, that the scientific cultivation of the mind of the mechanic, was, and still continues to be, my only object. For my friends, Mr. Robertson and Mr. Hodgskin, your original temporary Secretaries, *who first gave currency to the plan, and were the powerful means of organizing our first public movements*, I can with equal confidence answer."

While we thus firmly assert, as we ever shall assert, the claims of the parties who were the real founders of this Institution, we need not conceal from our readers, that the Institution did subsequently take course, which diminishes considerably the pride and satisfaction we might otherwise have derived from our share in its foundation. It is not in an incidental way like this that we can discuss the many points of individual conduct and of general interest, involved in the history of the London Institution; but Dr. Birkbeck and his friends may depend upon it that the day of honest reckoning will come (is likely not far off), when it will be placed beyond all cavil, how far a party, who has managed to push himself into the situation of directing a popular impulse of such vast importance as that of a desire for scientific instruction, has aided and strengthened that impulse, by the wisdom and energy of his measures, or paralyzed it by a feeble and passive, though undoubtedly well intentioned, system of superintendence. We may, in the mean time, just venture to hint, that the prospect of the London Mechanics' Institution, being rendered as "flourishing" and as "perpetual" as its warmest friends can desire, will not suffer in the least by its Directors making it their study to be as just and liberal towards others, as they doubtless wish that others should be towards them. No establishment ever yet flourished which took a falsehood for its corner stone; nor was there ever yet a reputation gained on the strength of another's merits, which an impartial posterity did not indignantly demolish.

MISCELLANEOUS NOTICES.

Fourth Day before New and Full Moon.—Virgil calls this fourth day a very sure prophet. If on that day, the horns of the moon are clear and well defined, good weather may be expected; but if they are dull, and not clearly marked on the edges, it is a sign that bad weather will ensue. When the weather remains unchanged on the 4th, 5th, and 6th days of the moon, we may conjecture that it will continue so till full moon,—even sometimes till the next new moon,—and in that case, the various changes in the moon's position have a very weak effect.

Durability of Timber.—On opening one of the tombs at Thebes, M. Belzoni discovered two statues of wood in good preservation; the only decayed parts being the sockets of the eyes. The wood of these statues is supposed by Mr. Tredgold (Principles of Carpentry) to be the oldest in existence that bears the traces of human labour.

Singular Difference of Temperature.—It is stated in the account of Capt. Parry's second Voyage of Discovery, in search of a North West Passage, that on the 8th of September, the superficial water drawn on the *starboard* side of the Fury was found, during the whole of the afternoon, to be of the temperature of 27½, while that which was taken from the *larboard* side reached, as uniformly, 30 and 30½. "The difference," says Capt. Parry, "was, perhaps, on this occasion, to be attributed to the sun being more on the larboard side than on the other; but nearly the same thing occurred on the 11th, when the reverse was the case with respect to the sun. In every instance the water was drawn in the same bucket, and from within a foot of the ship's bends: and to whatever cause it was to be attributed, it shows in how great a degree the tem-

perature of the surface of water may be affected by some local, and perhaps trivial circumstance." I wish to know whether any explanation has ever been given of this singular circumstance, and what that explanation is?—P.

Ancient Tesselated Pavement.—As some workmen were lately employed in making an excavation to enlarge the vaults of Messrs. Johnson, of this city (Gloucester), they discovered, about seven feet below the surface, a very curious Roman tesselated pavement, in a perfect state of preservation, running in a direction from north to south, but to what extent has not yet been ascertained. The colours are white and bluish grey. The tesseræ are about one inch in length, and three quarters of an inch in breadth. The cement on which the pavement is laid is several inches in thickness, and appears to be composed of sand, pounded brick, and lime, forming together a very hard substance. The white tesseræ are of a hard calcareous stone, and bear a good polish; and the grey are of a hard argillaceous kind of stone, found in many parts of Gloucestershire, and called blue lias.—*Gloucester Journal.*

Brown Colour from Soot.—M. Braconnot says (Ann. de Chimie), that a deep brown colour of various shades, for paper hangings, may be obtained, by simply diluting with water a mixture of soot and slaked lime.

Ocular Evidence of the Vibrations of Sound.—We noticed in two former numbers (144 and 207), the curious observations on this subject of M. Chladni, Dr. Young, and Mr. Wheatstone. By the following passage of a lecture delivered (9th May) by Mr. Farraday, at the Royal Institution, on Musical Sounds, we are reminded that some facts of a very analogous nature were long ago observed by the celebrated Galileo. "Whilst drawing a blade over a copper surface, to clear it, he observed that sometimes distinct musical sounds were produced; and, on examining the metal plate, he found that every time a sound was occasioned, the blade had formed a series of dots upon the metal plate—the dots being placed with the most perfect regularity, and equidistant from each other. When no sound was produced, no dots were formed, but one continuous line; and when the sounds were acute, then the dots were closer together than when grave sounds were occasioned, even though the blade moved slower for the latter sound than for the former. These dots he considered as the registers of the vibrations, or impulses which produced the sounds. The experiment is easily made, by holding the blade of a penknife near the handle, and then drawing it sideways over a plate of tin or copper, with the edge perpendicular to the plate. On carrying a sounding body, as a bell or a tuning fork, over the smooth regular surface of a soft body, as wax, a similar series of impressions are made." Mr. F. adds, that Mr. Hunt, of Birmingham, has proposed to construct a wheel, with its edge and surface prepared in this manner (made smooth and regular, and of some such substance as wax), by moving which with a certain velocity, while sounding bodies are brought near it, the number of impulses in a given time, which belong to any pitch or sound, may be ascertained by counting the dots left.

Scarlet Dye from Shell Fish.—The venerable Bede, in enumerating the rare productions of Britain, says, "There is also great store of shell fish, of which scarlet dye is made, the fine colour of which never fades with the heat of the sun nor the washing of rain, but the older it is, the more beautiful it usually becomes."—*(Hist. Eccles.)* This statement of Bede is correct in all its particulars; there are several kinds of shell fish, common to our coasts, which furnish a dye of the above description (similar, probably, to the *purpura* of the ancients), but since the introduction of cochineal, they are seldom sought after. Cole, in 1685, published a method of obtaining a scarlet dye from the *purpura lapillus*, to which Montagu, in the Supplement to his *Testacea Britannica*, has added several important directions. When the shell is broken in a vice, there is seen on the back of the animal, under the skin, a slender, longitudinal, whitish vein, containing a yellowish liquor. When this juice is applied to linen by means of a small brush, and exposed to the sun, it becomes green, blue, and purple, and at last settles in a fine unchangeable crimson. Neither acids nor alkalies affect its colour, and it may be conveniently employed in marking linen where an indelible ink is desirable. The *scalaria clathrus*, also, furnishes a purple liquor of considerable beauty, but it is destructible by acids, and gradually vanishes under the action of light. The *planorbis corneus* likewise yields a scarlet dye, but of still less permanence than the *scalaria*, as all attempts to fix it have hitherto proved ineffectual.—C. T.

Artificial Chalybeate Spring.—Professor Hare gives the following simple method of preparing an artificial mineral water:—Let a few pieces of silver coin be alternated with pieces of sheet iron, and the pile be placed in water. It will soon acquire a chalybeate taste, and a yellow hue; and in twenty-four hours flocks of oxide and of iron will appear. Hence, by replenishing with water a vessel in which such a pile is placed, after each draught, we have a competent substitute for a chalybeate spring. Clean copper plates, alternating with iron, would answer; or a clean copper wire entwined on an iron rod; but as the copper, when oxidated, yields an oxide, it is safer to employ silver.

The largest Steam Engine.—The most powerful steam engine in England, is stated by Mr. Farey (Treat. on the Steam Engine), to be that erected by Mr. Watt, at Hawkesbury Colliery, near Coventry. Its cylinder is 58 inches in diameter; the piston moves 8 feet in a stroke, and makes 12 strokes in a minute; the pump is 14 inches in diameter, and the lift is 65 fathoms.

NEW PATENTS.

Erratum,—In our last Number, for *Thomas Breid Euback*, read *Thomas Breidenback.*

John James Watt, of Stracey-street, Stepney, surgeon, for the application of a certain chemical agent, by which animal poison may be destroyed, and the disease consequent thereon effectually prevented.—28 April—6 months for enrolment of specification.

Charles Carpenter Bompass, of the Inner Temple, Esq., for improvements in the propelling of locomotive carriages and machines, and boats and other vessels.—29 April—6 months.

Thomas Millman, of Poplar, mast-maker, for certain improvements in the construction and fastening of made masts.—1st of May—6 months.

INTERIM NOTICES.

Communications received from Glevum—Fx—Mr. Ottley—C. H.—G. R.—Mr. Jackson—Philo-Metropolis—Mr. Walters—An Old Subscriber—M. P.

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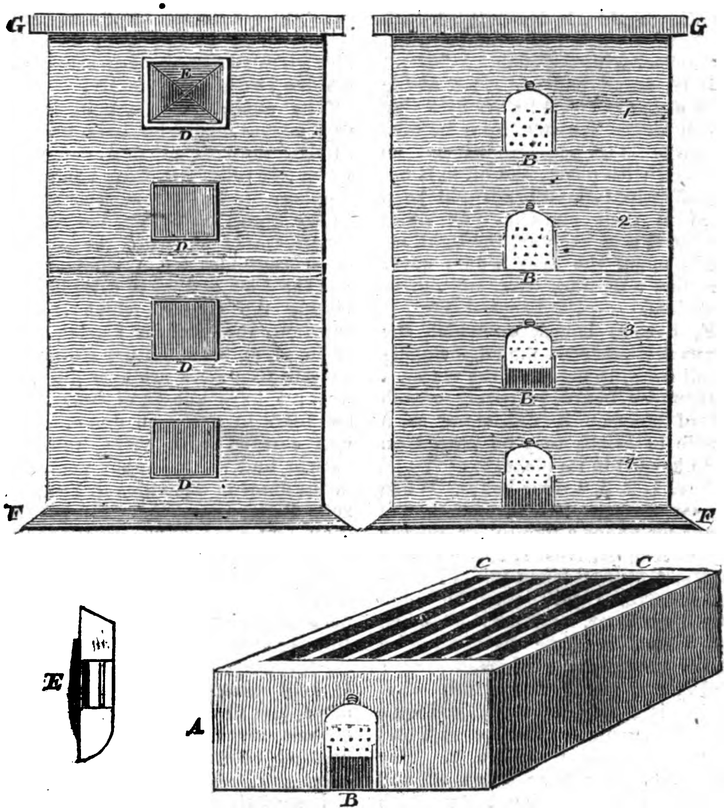
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 253.] SATURDAY, JUNE 21, 1828. [Price 3*d*.

MODE OF TREATING BEES IN RUSSIA.

BY MR. JOSEPH BUSCH, GARDENER TO THE EMPEROR OF RUSSIA.



To the Editor of the Mechanics' Magazine.

Sir,—If the description and drawings which I now send you, concerning the economy of bees, should come within the limits of your publication, it may be gratifying to some of your readers to adopt the following method, which, from many years' experience, I have found at once advantageous and humane,—avoiding the cruel custom of destroying the bees in order to procure the honey,—as will be seen by the following

Description of the Drawings.

A, bee-box, 14 inches square, 7 deep, made of 2-inch deal; will contain, when full, 24 lb. honey-comb, which gives 20 lb. honey, and 4 lb. wax. When a swarm is to be put in, three boxes are required. In the course of three weeks, this swarm

will have nearly filled the two upper boxes; in that case, an empty one must be placed under the three boxes.

B, square spaces cut in front of the boxes, 3 inches by 2½,—outlets for the bees, with tin sliders pierced full of small holes, to admit air when it is necessary to confine the bees.

C C, six thin laths, half an inch thick, neatly fitted into the box, and quite flush with the edge.

D D, small panes of glass, at the back of the boxes, 4 inches by 3; by which means the bees may be seen at work. The glasses must not be fastened with putty, the oil in it being offensive: small brads will keep them in their places. The small shutter E is to keep out the light, as, if left open, the bees would cover the glass with dark wax, and render it useless.

F, bottom board, on which the boxes are placed,—the edge sloping on all sides, to carry off the water.

G, upper board, or cover, to each set of boxes. A flat stone or a couple of bricks may be placed on it, to keep it in its place.

Nos. 1, 2, 3, 4, four boxes. When a new swarm has occupied the boxes for about a month, or by the end of August, Nos. 1, 2, 3, and part of No. 4, will be found full of honeycomb. No. 1 will then be quite free from bees, and may be taken off, which is done by placing a chisel between the edges of Nos. 1 and 2, and introducing a thin wire, which is drawn through, and cuts the honeycomb quite even, and separates No. 1 from No. 2. The box, No. 1, is then taken off, and a cover placed on No. 2, by which means the bees below are not disturbed; you then place an empty box under No. 4: the box of honey which has been taken off must be quickly removed into the house, otherwise bees from the neighbouring hives will attack it.

When bees are to be transferred from an old straw hive into boxes, a round hole must be cut in the cover G, and the straw hive placed upon it: the bees will soon work down into the empty boxes, and quit the old hive, which may be removed at the end of the summer.

Mr. Loudon recommends hives made of a hollow log, such as are used in Russia and Poland, but these would not answer in England; for, like our straw hives, they would contain honeycomb many years old. He is also mistaken, in saying that the Russians and Poles do not destroy the old hives, as the contrary is known to be the fact; as every hive gives two or three swarms, and maiden swarms, frequently.

The climate of England is not very advantageous for bees, because sudden showers of rain come on, when the bees are from home, and numbers are lost before their return. In the South of Russia, the climate is periodical; and when the rain sets in, it continues for a whole week, and the bees remain in their houses. During the winter, which is very constant, the hives are kept in sheds or caves, on high and dry situations. I doubt that bees are ever killed by frost: I have known of bees being for years in a church dome, which was covered with sheet iron. A swarm had settled many years ago in the dome of a pavilion in Yzarscozelio Park, where, to my knowledge, they had been above thirty years; on being taken down the quantity of honey and comb was astonishing: during this lapse of time, there had been above 28 deg. by Reaumur. Bees swarm, for want of space: give them room, and this will not happen. If kept warm in winter they eat more, and then die for want of food,—their stock of honey being exhausted before the cold season is over.

It sometimes happens that a hive has a good stock of bees, but that they do not advance in their work: the reason of this is, either that the queen is dead, or that the hive is attacked by robbers. To discover whether the former is the case, observe, when the bees return, whether they are loaded both with yellow and orange coloured farina,—for if this last is wanting, it is a sure sign that they have no queen. If you suspect the hive to be frequented by robbers, shut the tin

sliders at night,—that is, if you are sure of a fine morning. A few hours after sunrise, when other bees are in full flight, open them again, so that the bees may pass out, but with difficulty; have ready some dry whitening, (wheat flour must not be used, as it would make the honey ferment) and powder the bees as they go out, as many of the robbers are sure to remain over night; then observe if any of the powdered bees take to any one of your own hives. Your neighbours' hives must also be watched; by which means you will find the real abode of the robbers. When that is known, you have nothing more to do than to exchange the hives; namely, your neighbours' to be placed where the distressed bees were, and yours go in exchange to your neighbour; the same must be done in case the robbers are in your own colony. If your neighbour refuses to do this, recourse must be had to violence. Shut up your hive at night, and keep it closed during the ensuing day; place a shallow vessel filled with poisoned honey before the tin slider; the robbers will come as usual, take the poison, and carry it home; by which means his hive will be destroyed.

In case your hive has lost the queen, you must then divide it among the other hives that are the weakest, by placing part, or the whole, under another hive.

JOSEPH BUSCH,
Gardener to his Imperial Majesty.
St. Petersburgh, April 15, 1828.

MECHANICAL GEOMETRY—SEPTENARY SYSTEM.

(Translation from the French of our Correspondent "F.")

Sir,—To reply to the letter of Mr. Jopling (page 278) would require a volume, and not an article of a Journal. When I limited the problem to a semicircle, it was in order to bring it the more readily within the comprehension of the majority of your readers.

I have been occupied for a considerable time past with a Treatise on Cycloids and Concheids, according to their two modes of generation; and there I have carefully brought together the various researches of geometers respecting them, which are scattered through a great number of volumes, particularly the Transactions of different learned Societies.

As to the organical description of curves by means of angular movements, which has been proposed by Newton, and developed by Maclaurin, I cannot do better than refer to the excellent work of the Scottish Geometer.*

First Mode of Generation.

Any curve, in rolling upon another, engenders a cycloid.

The cycloid becomes an epicycloid when a circle rolls upon another circle as its base, and when the describing point is placed either upon the circumference of the generating circle, or within it, or without it.

The curve becomes a cycloid when the generating circle turns upon a right line as its base, and when the describing point is within, without, or upon, the circumference of the generant.

The class of curves produced in this manner furnishes three problems.

1. The base and the generant, with the describing point, being given, to find the cycloid produced.

2. A curve, with the generant, being given, to find the base.

3. A curve, and its base, being given, to find the generant.

Second Mode of Generation.

Any curve engendered by the extremity of a right line, while its other extremity describes a curve, is a concheid.

The class of curves produced in this manner furnishes two problems.

1. The base and the generating straight line, with the fixed point around which it turns, being given, to find the curve.

2. The curve and the generating straight line, with the fixed point

* "Geometrica Organica, seu Descriptio Linearum Curvarum Universalis." 4to. 1720.

round which it turns, being given, to find the base.

The conchoid of Nicomedes is produced when the fixed point is upon the generating straight line, or at its extremity, while the other extremity describes the curve, by remaining always at an equal distance from the point where the generant cuts the base.

The problem which I have proposed in your Journal (p. 250), is a very particular case of the second mode of generation; and to particularize it still farther, the point P may be supposed to be at the extremity B of the diameter.

An important observation, however, falls to be made here. The curve engendered is an epicycloid, if the generating diameter stops when it becomes perpendicular to its primary position; but if it move on till it regain that position, the curve extending from the point B to the point A is a particular conchoid, known by the name of *Pascal's Snail* (Limaçon de Pascal), because that great geometer was the first who directed attention to it.

A demonstration of these two interesting cases would require a long series of calculations; for it would lead us to an equation of the fourth degree, which is very complicated.

A corollary of these problems, which may be found also in the Septenary System, is, that cycloids degenerate into spirals, as conchoids degenerate into ovals. F.

N. B. It will be observed that when the fixed point P becomes moveable in B, the second mode of generation merges in the first; hence the reason why an epicycloid, which is only a particular modification of the cycloid, is the result. It may also be remarked, that the circle is the most simple case of the second mode of generation, as the cycloid is of the first; and, farther, that, in the second mode of generation, if the base is a spiral, the curve engendered is a spiral of the same species.

THE CURIOUS EXPERIMENT.

Sir,—With regard to the curious experiment mentioned by "W. H. B.," page 206, I beg to offer the following solution:—When the tray is dry and smooth, the glass rests on its centre, which is also its centre of gravity; and, on raising the tray on one side, the point in contact with the surface will be rather above the centre of gravity; and at length the glass will slide down the centre of gravity, moving constantly before or below the point of contact. But if there be a little water on the tray, the attraction or adhesion of the bubble between the glass and tray will be such, that, connected with the tendency of the water down the sloping tray, the points of contact of the glass and tray will be considerably below the centre of gravity of the glass, which centre will, therefore, revolve by the action of gravity; and as new points of contact continually occur below the centre of gravity, a constant revolution is thereby maintained.

It is not improbable the operations of nature in this simple experiment, if fully investigated, would be found analogous to those laws which retain the planets in their orbits.

I am, Sir,
Yours, &c.
VECTIS.

DESCRIPTION OF A SOUNDING-BOARD IN ATTERCLIFFE CHURCH, NEAR SHEFFIELD.

BY THE REV. JOHN BLACKBURN, MINISTER OF ATTERCLIFFE.

A paper with the above title, and of which the following is an abstract, was read at a Meeting of the Royal Society on the 5th instant:—

The church of Attercliffe had long been remarkable for the difficulty and the indistinctness with which the voice from the pulpit was heard: these defects have been completely remedied by the erection of a concave sounding-board, having the form resulting from half a revolution of one branch of a parabola on its axis. It is made of pine-wood; its axis is inclined forwards to the plane of the floor at an angle of about 10° or 15°; it is elevated, so that the speaker's mouth may be in the focus; and a small curvilinear

portion is removed on each side from beneath, so that the view of the preacher from the side galleries may not be intercepted. A curtain is suspended from the lower edge, for about eighteen inches on each side. The effect of this sounding-board has been to increase the volume of the sound to nearly five times what it was before; so that the voice is now audible, with perfect distinctness, even in the remotest part of the church; and more especially in those places, however distant they may be, which are situated in the prolongation of the axis of the paraboloid. But the side galleries are also benefited, probably from the increase of the secondary vibrations excited in a lateral direction. Several experiments are related illustrative of these effects; among which the most striking was one in which a person, placed so as to have one ear in the focus of the paraboloid, and the other towards a person speaking from the remote end of the church, heard the voice in a direction the reverse of that from which it really proceeded. The superior distinctness of sounds proceeding from the focus, is accounted for by their all arriving at the same moment of time, at a plane perpendicular to the axis, after reflection from the surface of the paraboloid; which is a consequence of the equality of the paths which they have described.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

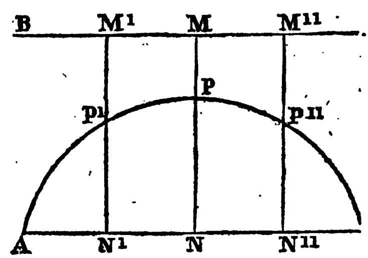
(Continued from p. 326.)

40. Hitherto we have considered the operation of finding fluxions as merely subsidiary to its converse, or to the finding of fluents from their fluxions; but they have other important uses, and are themselves intrinsically valuable for the aid which they afford us in many problems which do not involve the consideration of fluents.

1. The most interesting of these are the investigation of the maxima and minima of quantities.

If a quantity first increase, and then decrease at the point at which it ceases to increase, and begins to decrease, it is called a maximum, from a Latin word which signifies greatest; as at that point it has attained* a magnitude greater than its preceding and succeeding magnitudes, or the greatest magnitude which it admits *thereabouts*.

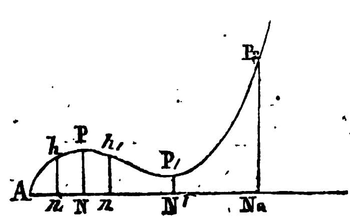
Similarly, if it first decrease, and then increase at the point where it ceases to decrease, and begins to increase, it is called a minimum, from another Latin word signifying smallest.



Thus, in the case of the ordinate NP of a circle whose centre is N, if $N^1 P^1$ advance along the line $AN^1 NN^{11}$, it keeps continually increasing as far as N P, and after it passes N P it begins to decrease at N P; therefore it is a maximum.

Again, if we consider the circle as described by the end P of the variable line $M^1 P^1$, moving along $B M^1 M$, then $M^1 P^1$ continually decreases as

* Let A P P^1 P^2 be a curve line. If



N P is greater than $n\,p$ and $n^1\,p^1$, it is a maximum, according to our definition; though at a future point, $N_2\,P_2$, it may be greater than its value N P, which was a maximum.

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far as M P, and after that point increases; and therefore at M P it is said to be a minimum.

It is evident that as the fluxion of a quantity is nothing but its rate of increasing or decreasing at that point where it neither increases nor decreases (*i. e.* where it is a maximum or minimum), it can have no fluxion. Whence, by taking the fluxion of a variable quantity which admits of a maximum or minimum, and putting it equal to 0, we shall obtain the value of the variable, when it is a maximum or minimum.

Example 1.

We will take for an instance the same case of the circle.

Reckoning from A, the equation is

$$y=\sqrt{2rx-x^2}.$$

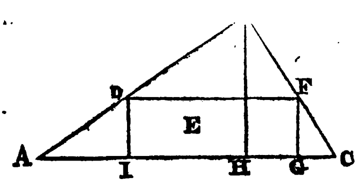
To find when y is a maximum, we must put $y^{\cdot}=0$.

$$\text{Now, } y^{\cdot} = \frac{x^{\cdot}.\overline{r-x}}{\sqrt{2rx-x^2}} = 0$$

Now, we know from the definition of $x^{\cdot}$, which is always finite that it is not the factor which makes $\frac{x^{\cdot}.\overline{r-x}}{\sqrt{2rx-x^2}} = 0$. Hence, $\overline{r-x}$ must be that factor. Therefore, when y is a maximum, $r-x=0$, and $x=r$; or y is a maximum at the centre of the circle, which is evidently true.

Example 2.

Suppose it is required to inscribe the greatest parallelogram in a given triangle.



Let A B C be the triangle, and D F G I the figure required.

Draw B H perpendicular to A C; put A C $=a$, B H $=b$, B E $=x$; then E H $=b-x$.

And since, by the similar triangle (Euclid, Book vi.),

B H : A C :: B E : D F
or b : a :: x :: D F

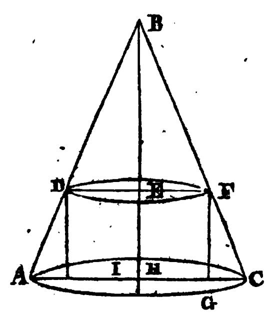
We have D F $= \frac{ax}{b}$.

Hence the area D F G I $= \frac{ax}{b}.(b-x)$, a maximum, by our hypothesis.

* Now, as the multiplier $\frac{a}{b}$ is constant, $x.\overline{b-x}$ is a maximum: its fluxion is $bx^{\cdot}-2x.x^{\cdot}=x^{\cdot}.(b-2x)=0$. Hence, $x=\frac{b}{2}$, or E H $=\frac{1}{2}$. B H.

Example 3.

Let us retain the same letters, and suppose it is required to inscribe the greatest possible cylinder in the given cone A B C.



We may remember that the solid content of a cylinder is equal to the area of the base multiplied into its altitude.

Now here the base $=$ B C. E D^2 $= \frac{\text{BC}.\,a^2x^2}{b^2}$, and the altitude $=$ E H $=\overline{b-x}$.

Hence the solid $= \frac{c\,a^2x^2}{b^2}.\overline{b-x}$ a maximum. Therefore $x^2.\overline{b-x}$ is a maximum, and its fluxion $(2bx-3x^2).x^{\cdot}=0 \therefore x=\frac{2b}{3}$, and E H $=\frac{1}{3}$. B H.

(To be continued.)

* For the maximum or minimum value must depend on the variable factor.

PLAN FOR THE PRESERVATION OF SHIPPING DURING EASTERLY GALES ON THE NORTH COAST.

Sir,—Being a constant reader of your valuable Magazine, you will greatly oblige me by inserting the accompanying letter, which I addressed to the ship-owners of Newcastle, &c. &c. about three years ago, shortly after a very destructive gale from the Eastward, accompanied with snow, occurred, in which many lives were lost; and as every succeeding winter adds some fresh disaster to the shipping on that coast, may I beg the favour of calling the attention of your numerous readers to the subject, and requesting that they will *(in the cause of humanity)* give their ideas upon its circulation in your Magazine, that some plan may be adopted by the ship-owners for the safety of so many valuable lives and property.

I am, Sir,
Yours, &c.
W. Clegram.
Canal Office, Gloucester.

" *To the Ship-Owners and others, belonging to Newcastle, Shields, Sunderland, and the Ports adjoining.*

" Gentlemen,—The many valuable lives, and great number of ships, belonging particularly to Newcastle, Shields, Sunderland, and the ports adjacent, which are lost almost every winter on the North coast during the prevalence of Easterly gales of wind, in the thick snowy weather which generallyaccompanies those gales, has long called for some remedy (if one can be found) to avert the dreaded evils of such a period, at the same time to act as a guide to the mariner into either of the above ports.

" It is doubtful, perhaps, whether efficient means can be derived wholly to prevent a recurrence of such disasters on an exposed coast like the one alluded to; but that measures may be adopted greatly to lessen the danger, I have no hesitation in affirming.

" The plan I beg to submit to your notice is very simple, and may be carried into effect at no great expense. It is as follows:—I propose a row of buoys to be laid off from the shore, in a leading line (about E.S.E. and W.N.W.), into both Shields and Sunderland harbours, to the distance of about six miles out to seaward, at about one quarter of a mile apart, to be made distinguishable by being painted either red or black, and marked at the top of the buoy—Shields, for those leading into that harbour, and Sunderland, on those leading into the latter place; and to be numbered 1, 2, 3, &c. &c. from the shore outwards, which will not only give the bearing into either of the harbours, but the distance from the land also.

" When vessels, either running or laying to in the weather beforementioned, fall in with any of the said buoys (which they are almost sure to do, if there be a fleet), they can easily communicate the intelligence to others, who should all make the same signal, not only as an answer that the signal is seen and understood, but to communicate the same to those astern, by hoisting an union jack, or ensign, in any conspicuous part of the vessel, to denote they are in sight of the buoys;* and by making sail, should the tide suit, the vessels astern would follow the leading ship or ships until they also made the buoys, which would lead them into the harbour the buoys or the signal represented.

" Should the vessels bound to Shields fall in with the Sunderland buoys, it would give them a new departure; and, from the number of the buoy, they would know how to steer, so as to make the Shields buoys; and should the vessels intended for Sunderland unfortunately miss the Sunderland buoys, there would still be a chance of their falling in with those of Shields; and

* " The Sunderland signal may be hoisted on the foremast, and the Shields signal on the mainmast. Sloops may hoist the Sunderland signal at the mainmast head, and that of Shields at the gaff end, or on the topping-lift, should the mainsail be furled.

should they pass those of both harbours, they would then only be in the same condition as they are now without the buoys. The buoys might frequently prove serviceable to ships in the night; for if once seen, the course to the harbour will be known.

"The expense may be defrayed by a small charge per ton, once a year, on each vessel passing the buoys.

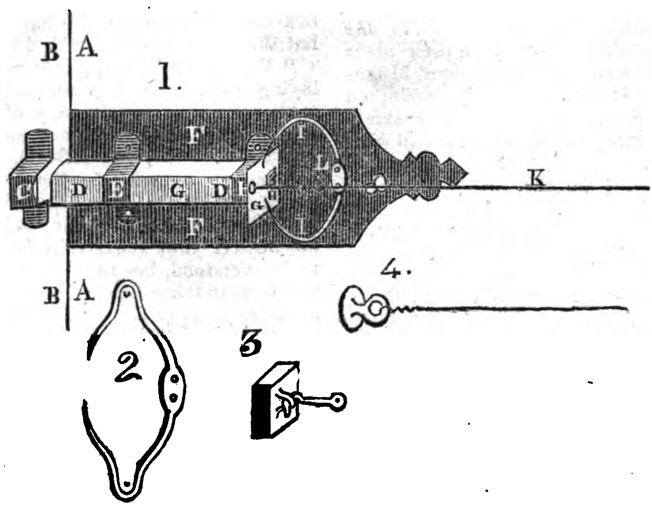
"Should this suggestion meet with your approbation, and be adopted, it will, I trust, be the means of saving many valuable lives, and considerable property. As it may prove useful, so will it be a lasting source of satisfaction to me, that I have been the means of diminishing the complicated risk and perils of a dangerous and exposed coast, and contributed to the security and welfare of that grand nursery for seamen—the North Country Trade.

"I am, Gentlemen,

"Yours, &c.

"William Clegram."

IMPROVED BED-CHAMBER BOLT.



Sir,—Within these few days I have had the good fortune to be favoured with the loan of your very valuable publication; and finding, on perusal, that its pages are open to all who may have any thing new to suggest (however humble), if in any way tending to the advancement of the mechanic art, or likely to become serviceable, I take the liberty of troubling you with a plan of what I consider an improved bed-chamber bolt.

Description.

Fig. 1, A A, the door; B B the door-case, to which is affixed the staple C; D D the bolt, which is made with a projecting edge, similar to the hasp of a lock, to enable the end of the bolt to slip into it with greater facility, when the door is pulled to. (I have thrown this back a little out of its place, in the drawing, to show the end of the bolt). The other end of the bolt is enlarged by means of a projecting rim (except next the plate F F), to admit of the spring I I having plenty of room to work, and on it are two loops: the upper one G is for the wire K to be attached to; the lower one H is intended for the hook L, to keep the bolt back when out of use, and is made with a square neck, which serves as a stop

to prevent the spring being over-strained; for which purpose, it will be seen, this loop is placed exactly between the ends of it. E E are two staples to secure the bolt to the plate; F F, the plate on which the bolt slides; G and H, the two loops above described; I I, the spring, secured to the plate by two screws; K the wire, which, by means of cranks, and a pull similar to the hanging of a common bell, will enable a person in bed (in whatever part of the room it may be situated), to withdraw the bolt; L, the hook.

Fig. 2, another spring, shaped like a double latch spring, which, if considered superior to the one in fig. 1, can be substituted for it.

Fig. 3, the loop H, on a larger scale, showing more distinctly the square stem, and the use of the hook L.

Fig. 4, the loop G, on a larger scale, with the wire K attached to it.

This bolt will not only supersede the necessity of getting out of bed to unlock the door in order to give admission to a servant whose attendance may be required; but, from its being opened with so much ease, in case of accidents by fire, or otherwise, will remove an objection which has been very generally, and, I think, justly, raised against fastening the bed-chamber door, viz. the difficulty of obtaining egress when in a state of agitation or alarm.

I am aware that bolts for a similar purpose have been long in use; but all that I have yet met with have been of a most clumsy description, and not in the slightest degree resembling mine, which I believe to be original.

That I have not tried it I confess; but have so frequently seen springs in various articles acting in a similar way to the one I have used, that I have not the least doubt of its answering.

I am, Sir, yours, &c.

A Son of a London Watchmaker.
Worthing, March 1828.

P. S. The staples, plates, &c. &c. can, of course, be made as ornamental as the fancy of the manufacturer may dictate.

"Q. E. D.'s" VINDICATION OF HIS SOLUTION OF THE GEOMETRICAL PROBLEM, NO. 231.

Sir,—Living in an *out-of-the-way* village, I do not receive the Nos. of your Magazine regularly; and having been absent from home, I have only just seen your 246th No.

My solution of the problem, No. 231, I wrote off upon first reading the enunciation, and have had no time to look at it since. With regard to "F.'s" objections,—1st, According to the *proposed problem*, the lines joining the angular points and a given point taken within the triangle are given. These lines are, therefore, given in position as well as extent; for, otherwise, it should have been stated that these lines were respectively equal to three given straight lines. 2dly, The three lines joining the angular points and a point within the triangle being given, the angular points themselves are given; they are not, therefore, "indeterminate." 3dly, With regard to the point A, "F.," I suppose, refers to its falling in the perpendicular K E. This was accidental, and does not in the least affect the proof. For having drawn the three given lines A B, A C, A D, and thus taken the angular points, and, in fact, the triangle, no further use is made of the point A, or the three given lines; and the point might just as well have been in any other part of the area B D C.

With regard to "G. S.'s" sweeping affirmation, that my solution is "wholly incorrect," if he means that I have mistaken the meaning of the enunciation, or, at least, of the proposer, and that, therefore, my proof has nothing to do with the matter, I think, possibly, he is right; and that the enunciation should have been similar to that he has given: but as it stands in No. 231, and considering the lines given both in extent and position, I conceive my solution is correct. If "G. S." can point out any error (under the above supposition), I trust I shall be open to conviction, and not uselessly take up your pages, as was lately the case with an opponent of "G. S.," if he

be the same "G. S." who so ably entered the lists on the side of Mr. Russel and the Old Light System.

I am, Sir, yours, &c.

Q. E. D.

May 30, 1828.

[Solutions of "G. S.'s" statement of the problem, in our next.]

THE QUESTION IN MENSURATION. (P. 30, VOL. IX.)

Sir,—As the particular solution by Mr. Brian Evred (page 236), differs nearly *one yard* from the result of the two general solutions that precede it, I beg leave to point out where the error in his solution originates. The tabular area is taken by Mr. B. E. at ·074573, instead of ·071387; which being rectified, the sides of the required square comes out 39·24 yards, being only *one hundredth* of a yard less than the radius of the greater circle. And even this small difference would of course diminish, if we carried the decimal places to greater extent.

I am, Sir, yours, &c.

VECTIS.

HISTORICAL ACCOUNT OF IRON BRIDGES.

Sir,—As you thought the description of the suspension bridge over the Menai Straits worthy a place in your Magazine, I have taken the liberty of sending you a descriptive account of some of the earliest bridges which were constructed of cast iron.

The first cast iron bridge of any consequence was over the river Severn, near Colebrook Dale, in Shropshire. It consists of an arch of above 100 feet span, and rises 45 feet. There are five ribs, each cast in two pieces, secured where they join at the crown of the arch by a cast iron key-plate, and connected together horizontally and vertically by cast iron braces, formed with dove-tails and forelocks; the ribs are covered with cast iron plates, and the railing to the sides is of iron. The total weight of iron is 378½ tons. This bridge was built by Mr. Abraham Darley; and the iron work was cast at Colebrook Dale in the year 1779. It was a very bold effort; for in the first instance, in adopting a new material, the span of the centre arch at Blackfriar's Bridge was exceeded; and that had always been considered as a great exertion with stone.

The second iron bridge was built over the same river, about two miles above the former one, at a place called Buildwas. It was erected at the expense of the county of Salop, agreeably to a plan, and under the direction, of Mr. Telford, Surveyor of the public Works of that county. It was cast, also, at Colebrook Dale, in 1795 and 1796. The arch is 130 feet in the span, and rises from the springing to the soffit of the arch, 27 feet. In this bridge, as it was necessary to keep the roadway as low as possible, the principle of the Schaffhausen and Wittingen bridges is in some degree adopted; for the outside ribs are made to go up as high as the railing; they are connected with the ribs that bear the covering plates, by means of pieces of iron dovetailed in the form of king-posts. The plates which form the covering over the lower ribs are cast with deep flanches, are laid close to each other, and form an arch of themselves; so that, altogether, the bridge is compact and firm. The weight of iron is nearly 174 tons.

Some smaller bridges, and an aqueduct at Longden (the first made of iron, for a navigable canal), have also been made in Shropshire, under Mr. Telford's direction.

The next bridge, on a large scale, which was made of iron, was that magnificent and elegant one over the river Wear, at Monk Wearmouth, near Sunderland. The projector and architect was Rowland Burdon, Esq., M. P. The arch is a segment of a circle, whose diameter is about 444 feet. The span of the arch is 236 feet, and its versed sine, or spring, is 34 feet. It springs at the elevation of 60 feet from the surface of the river, at low water; so that vessels of 200, or perhaps 300 tons burden, may pass under it in the middle of the stream, or even 50 feet on each side of it, without lowering their top-masts. This bridge is ren-

dered very considerably lighter than it could have been, if made of stone, by means of the great voids which cast iron will permit, and the simplicity with which that metal may be reduced to any form. The blocks are so cast as to serve as arch stones; and in the arch they abut on each other, in the same manner as the voussoirs of a stone arch: the thickness of the arms of which a block is constituted, is no more than 4 inches; the longest dimension of a block is about 3 feet, and its weight about 4 cwt. These are kept in their places, and made to bear accurately upon each other, by bars of wrought iron, which run along grooves on each side of the blocks, and are bolted through at equal distances to braces of cast-iron passing horizontally between the ribs; of six of which, placed at five feet distance from each other, the arch consists: one rib contains a series of about 125 blocks. This admirable structure is able to withstand an enormous pressure, so long as the abutments of the arch do not spring; and of this there is hardly any risk, because they are solid rock faced with about four or five yards of solid block masonry.

It were desirable, though, that something were done to stiffen the arch at the sides, by the manner of filling up the spandrils, or space between the arch and the roadway. They are so filled up as to be extremely light and pleasing to the eye; namely, by large cast iron circles, which touch the roadway and the extrados of the arch: the roadway rests upon them as on so many hoops, while they rest on the back of the arch, and also touch each other laterally. But this cannot contribute much to the strength of the arch; for these hoops will be easily compressed at the points of contact, and, changing their shape, will oppose very little resistance. This part of the arch might have been greatly strengthened by connecting it with the roadway by trussed frames, in the same manner as a judicious carpenter would have framed a roof. The arch contains only 260 tons of iron, of which about 56 are wrought iron. The superstructure is of wood, planked over at top. This floor is covered with a coating of chalk and tar, on which are laid the materials for the carriage road, consisting of marle, limestone, and gravel, with footways of flagstones at the sides. The weight of the whole does not exceed 1000 tons; whereas the lightest stone arch which could have been erected would have weighed 15,000. It was turned on a very light but stiff scaffolding, most judiciously constructed for the preservation of its form, and for allowing an uninterrupted passage for the numerous ships and small craft which frequent the busy harbour of Sunderland. The mode of framing the arch was so simple and easy, that it was put up in ten days!! without an accident; and when all was finished, and the scaffolding removed, the arch did not sensibly change its form. This noble structure was finished in the autumn of 1796. It was executed at the expense of about £25,000, of which sum £19,000 was advanced by Mr. Burdon.

I am, Sir,

Yours, &c.

TIM BOBBIN.

FIXING BLACK LEAD WRITING.

Sir,—I have seen in your useful Work several methods for fixing black lead pencil writing; and in the Part for Dec. 1827, there is a plan proposed, of covering the sheet of paper, *after written upon*, with skim milk, and then pinning it against the wall to dry. But generally from home we make use of memorandum *books;* and, in such case, the plan proposed is quite unsuitable, being confined to sheets of paper only.

I have a method to recommend, which will answer either for sheets of paper or for books. It is as follows:—Make a weak solution of white gum arabic, taking care to pick the white or clear gum from the yellow, as the white is best for this purpose; and to this add a small quantity of salt, just sufficient to give the gum water a saline taste. Procure six sheets of demy or fools-

cap paper, according to the size you want your book; either of which, when folded octavo-wise, will make forty-eight leaves. With a camel-hair brush, two or three inches wide, such as varnishers use, apply the gum water on both sides of your paper; and when dry, if not stationer enough yourself, give the paper to your stationer to make it up into books for you. After you have made your memorandums upon it, lay aside the book in a damp place for a day or two. The salt will soon cause the gum to be affected with the damp, and in that state to incorporate the pencil marks into its own body; after which, the book being kept in the pocket, or in a dry place, it will be impossible to obliterate the writing.

I am, Sir,

Yours, &c.

ABRAHAM ORCHARD.

Nanty-Glo. Iron Works, Monmouthshire.

COMPOSITIONS FOR GLAZING EARTHEN VESSELS WITHOUT LEAD.

1st. Take four parts of calcined soda, and five of white sand (free from iron); mix them together, and reduce the whole to a very fine powder. Put this powder into a crucible, made of very compact clay,—previously rubbing it with chalk on the inside,—and expose it to the strongest heat of a potter's furnace. When taken out, the composition should be melted, and have the appearance of blown glass. Reduce it to an impalpable powder, in which state it is fit for use. This glazing penetrates into the pores of earthen vessels, is susceptible of a beautiful polish, and not liable to be acted upon either by acids or alkalies.

2d. Take thirty-two parts of glass, sixteen ditto of borax, and three of tartar; prepare them in the same manner as above, except that the borax must be calcined separately.

3d. Take fifty parts of soda, ninety ditto of silex; cast the silex red-hot into cold water; pulverize it, and melt the whole.

4th. Take eighty parts of soda, seventy ditto of sand, and ten of white clay; calcine the soda, and afterwards melt it with the other ingredients.

5th. Take three parts of calcined soda, and four of quartz sand, and melt them together.

6th. Take one part of powdered pumice-stone; mix and melt it with one-sixteenth of pulverized oxide of manganese.

L.

ANSWER TO A CONSTANT READER (P. 231, VOL. VIII.)

The length of the line must be $109\frac{3}{10}$ inches.

Given a=18 in., b=13 in., c=9 in., d=$5\frac{1}{2}$ in., and e the large wheel =22 in.

Required h=10·4, g=15·8, f= 19·3.

The distance of the centres is 32 inches; *a h*, *b g*, *c f*, *d e*, are pairs of pulleys.

W. ANDREW.

THE THAMES TUNNEL.

It appears from the parliamentary proceedings, that the Directors of this undertaking have obtained an Act for raising, by way of loan, the money required for its completion. We have always said that it would be in this way, the difficulties in which it has become involved would be ultimately got over; and we are now warranted in concluding that the project of obtaining assistance from Government, and the still sillier one of raising the necessary means by voluntary subscriptions, have both equally failed.

The money to be borrowed under this Act is limited to 200,000*l.*; but it is estimated by the Directors and their Engineer, that no more than half this sum will be wanted. It is probable, indeed, that after deducting the various expenses, in the shape of commission, discount, &c. attendant on the raising of the money, not much more than one-half in hard cash could in any event be realized. With the view of inducing capitalists to subscribe to this extent, the Directors have published a series of

Resolutions adopted at a special general Meeting of the Proprietors, held on the 11th of May last, in which the prospects of the concern are represented to be highly promising, provided only this additional trifle of 100,000*l*. can be obtained. We are spared the trouble of criticising these Resolutions minutely, by the communication, which we subjoin, from "A Proprietor," who has conveyed, in an ironical way, some very sensible and matter-of-fact views on the subject. We agree with this "Proprietor," in thinking that better assurance than any which the Directors have yet offered is wanting, that the 100,000*l*. will suffice for the completion of the Tunnel; and must say further, that it is by no means dealing fairly with the public, to hold forth that "financial obstacles" are the only obstacles which stand in the way of its completion. Before a shilling of this 100,000*l*. can, in perfect honesty, be accepted, it should be placed beyond all reasonable doubt, not only that the Tunnel can positively be completed for 100,000*l*., but that every possible precaution has been taken to prevent the recurrence of such irruptions of the river as those which have heretofore proved so disastrous. *No assurance of Mr. Brunel's alone can be sufficient.* Suppose for a moment that the 100,000*l*. now wanted should be subscribed, and that it should prove inadequate (as is but too likely) to the completion of the Tunnel, what will then become of the lenders and their bonds? Will not they be obliged,—as the original Proprietors are now doing in respect to them, and as has in many like cases been done before,—to forego their claims in favour of another and newer set of bondholders, who will advance such farther sum as may be necessary to finish the work, and come in for the first fruits of all the money that has been expended, both by the original Proprietors, and by the first set of bondholders upon it? It may be a pleasant enough thing to engineers, contractors, and others, into whose pockets all the money goes, to look forward to such inevitable and usual results as this; but there are gentlemen in the direction of the Thames Tunnel, who would not, we imagine, be intentionally parties to the positive fraud (we can but call a cat, a cat) which is in all such cases committed on public credulity.

"*Broad-street*, 12*th June*, 1828.

"Sir,—An advertisement having appeared in the newspapers, setting forth what is incorrectly stated to be a series of Resolutions adopted by a Special General Meeting of the Proprietors of the Thames Tunnel, held on the 11th of May; I send you herewith a copy, *verbatim et literatim*, of the Resolutions which were actually passed on that occasion, and beg that you will give them publicity through your widely circulated journal. The parts which I have marked to be printed in italics, are such as have been altogether omitted in the advertisement alluded to.

"I am, yours, &c.

"A PROPRIETOR."

Resolutions.

"1. That the Tunnel having been completed to the extent of 600 feet from the shaft at Rotherhithe, and there remaining only 350 feet to arrive at low water mark, near Wapping, this Meeting receives with satisfaction and confidence the expressed opinion of Mr. Brunel, the engineer of the Company, that the Tunnel may be completed; *considering, as this Meeting does, that in the space of 200 feet, which have been already excavated within low water mark, under the directions of Mr. Brunel, the water has only broken in three* times; that rivers, notoriously, never make irruptions at high water; that independently of the great reliance which Mr. Brunel's past success justifies the Meeting in reposing on any opinion of his, the one he has now expressed is no more than what everybody else entertains; namely, that the Tunnel "MAY be completed;" and that to have inquired of other competent engineers, whether it is likely that it WILL be completed, with the means now provided for the purpose, would, after such assurance, and under such circumstances, have been equally impertinent and useless.*

* There was a *third* irruption of the river subsequent to the two which have been noticed in our pages, but it was of a trivial nature, and did but little damage. —EDIT.

"2. That the Directors be authorized to raise, under the authority of the Act of Parliament recently passed, such sums of money as they may deem necessary for the completion of the undertaking, not exceeding 200,000*l.*, with power to make such allowances as they may consider reasonable to those who may assist in raising the money; *the Meeting having reason to think, that after the very decided and satisfactory opinion expressed by their engineer, Mr. Brunel, that the Tunnel* MAY *be completed, capitalists must now be so eager to invest money for the purpose, that not more than a bonus of fifty per cent. will be necessary to induce Jew brokers and others to embark with heart and soul in the speculation.*

"3. That when a sum of 100,000*l.* shall have been agreed to be subscribed, the Directors do proceed with the works, and commence making their call on subscribers; this Meeting being of opinion, that when that sum shall have been secured, every financial obstacle in regard to the completion of the Tunnel will have been overcome; *it having been satisfactorily shown to the Meeting, that though upwards of 200,000l. have been expended in excavating the Tunnel to the extent of* 600 *feet, that furnishes no reason whatever for suspecting that there can be any error in estimating that the remaining* 700 *feet can be executed for half the sum.*

"4. That the account of the tolls of the Tunnel, estimated on the principle of their exceeding the tolls taken annually on the Waterloo Bridge (which in the last year amounted to 13,684*l.*), will, in the opinion of this Meeting, be more than sufficient to pay interest on the money to be raised, and leave, with the revenue from the freehold property and other effects of the Company which will not be required for the purposes of the Tunnel, an income for the proprietors in respect of the capital invested; *it being clear to the Meeting that income is income, however small, and that ever so little is better than none at all.*"

NEW PUBLICATIONS

Connected with the Arts and Sciences.

The Enigmatical Entertainer, and Mathematical Associate, for the Year 1828. 24 pp. 8vo. Davis and Dickson.

Few of our readers can be unacquainted with those two favourite publications, "The Ladies' and Gentlemen's Diaries," which have contributed so long and so effectually to the diffusion of a taste for mathematical inquiry. The present is a cheap work (1*s.* per Number), of a similar description, undertaken, not from "any spirit of opposition," but under the impression that "the prescribed limits" of these two publications "necessarily oblige them to omit inserting much that is valuable;" and with the view of affording "a wider field for the exercise of the abilities of the enigmatist and mathematician."

The first Number, which we have now before us, contains twenty enigmas, twelve charades, ten rebuses, ten anagrams, and thirty-two questions, philosophical and mathematical. Answers to all which are to appear in the second Number of the work, which will be published in October, 1828.

The merely entertaining questions in this Number bear, we think, too large a proportion to the useful, and are of a certain antiquated description, for which we must make bold to say (the ire of the whole "little world of enigmatology" notwithstanding) we have neither liking nor respect. We thought the day of charades, and rebuses, and enigmas of every description, was fast passing away; and know of no purpose which can be served by deferring their exit, except it be the encouragement of wretched rhymes, and still more wretched conceits of all sorts. The powers of the mind are sharpened, we admit, by every effort to unriddle what puzzles it; sagacity, reflection, memory, imagination, are all, more or less, called into play; but not until nature herself has ceased to furnish us with abundance of phenomena, calculated both to instruct and amuse, can we allow that such verbal mince-meat as is invariably served up at these riddle-me-ree entertainments, is good food for either men or boys. Can any thing, for example, be sillier, or, after all, more easy of solution, (only think of a whole year being given for the purpose!) than such exercises as the following:—

"*Fourth Charade, by Mrs. S. Clay.*

My first is of the feather'd kind,
 Yet ne'er was known to fly;
My next, would you improve your mind,
 Seize, seize, ere it pass by.

My whole oft grieves the playful boy,
 When it approaches near;
He must lay by each pleasing toy,
 And for my first prepare.

Eleventh Charade, by T. D. Sheridan.

Near to the streams my first is found,
 Whose currents swiftly glide;

Or in the mead with daisies crown'd,
Or up the mountain's side;
What music from my second flows,
If harmony attend;
Or it a message may enclose
From lovely Mira's friend.

My whole augments the miser's store,
Which he beholds with glee;
But though I'm welcome to the poor,
'Tis death to copy me."

We hope the editors of the "Entertainer" will steer clear of such trash in their future Numbers; and if they cannot venture the length of discarding enigmas entirely, that they will at least endeavour to give them a useful direction, and thus render their publication more in consonance with the enlightened character of the age in which it makes its appearance.

The philosophical and mathematical questions present, fortunately, abundance of redeeming matter; and though in more than one instance we recognize an old acquaintance, they seem generally what they profess to be, "new;" and are, at least, all well calculated to exercise ingenuity, and elicit useful information. Such questions as the following may occupy, profitably, the attention of men of the highest attainments:—

"If a body revolve in an elliptical orbit, it is required to determine a point where its angular velocity is an harmonic mean between its greatest and least velocities?"

"If a globe of ash, 10 feet in diameter, be depressed in water till it is level with the surface, and then be suffered to ascend, it is required to determine the time of its ascent?"

"Out of a reservoir irregularly supplied with water, a constant supply is wanted for certain purposes, and it has been found that a rectangular perforation, the breadth of which is b, and depth d inches, will yield the quantity wanted when the reservoir is full; but this being seldom the case, another aperture, having its base in the same right line with the upper side of the former one, is wanted, which is to be entirely closed by a shuttle, when the reservoir is full. Now, suppose the shuttle to be connected to one end of a lever (the arms of which are a and e inches in length), to the other end of which a buoy is fixed, which floats in the reservoir, raising or depressing the shuttle, as the water in the reservoir falls or rises; what must be the equation of the curve of the upper aperture, so that the same quantity of water may be certainly discharged?"

We look forward with curiosity to the answers which these, and other similar questions will call forth, and do not hesitate on the strength of the expectations which they justify, to recommend most cordially, the "Enigmatical Entertainer and Mathematical Associate" to the favour and support of our readers.

MISCELLANEOUS NOTICES.

Ancient Tunnel.—Babylon was divided in the middle by the river Euphrates, and had on each side an extraordinary structure. On one side stood the Regal Palace, or Seraglio; and on the other the Temple of Jupiter Belos. Between these edifices there were two channels of communication, and both stupendous works. The first was a bridge of five stadia (3125 feet) in length, supported by strong piers twelve feet apart. The second was an arched tunnel, under the river, of brickwork, 15 feet wide and 12 high. Strabo fixes the breadth of the Euphrates at only one stadium (625 feet); but as it is reasonable to presume the same allowance would be made for its overflowings and the lowness of its banks, in the case of the tunnel as of the bridge, it may be concluded that they were both of nearly the same length. The tunnel now in progress under the Thames will only, when completed, be 1,300 feet in length, or 1,825 feet shorter than this of Babylon; but the latter was the more easily constructed of the two, as Herodotus records that the waters of the Euphrates were diverted from their bed, previously to the bridge and tunnel being commenced.

Russian Mines.—In the course of the year 1825, and the first half of the year 1826, no less than 14,000 pounds of gold, being of the value of nearly 895,000*l.* sterling, were obtained in the Oural Mountains, near Catherinebourg, in the government of Perm. Of platina, there were also obtained 846 pounds, during the same period; and a description of coin in this metal has been recently issued by the Russian Government.

Extraordinary Climbing Plant.—The cogue, of Chili, is one of the most singular climbing plants ever noticed by naturalists. It is not, like the hop, convolvulus, or the vine, contented with the support afforded by a single tree; but when it has reached the top of one, it shoots down again, and in a short time attains the summit of another. Proceeding in this manner, it has been known to extend over a space of more than two hundred yards. The toughness and pliability of its stems render them valuable for making baskets, and even cables.—*Athenæum.*

Chinese Mode of Fishing.—The Chinese catch fish by the following method:—They employ two straight boats, with a board painted white, and varnished over, nailed to them. This is made to slope outwards, and almost touches the surface of the water; the colour of which it is made to take, by the reflection of the light of the moon. Towards this the fish dart, fall on the board, and are caught without further trouble.—*Ibid.*

Magnetic Phenomenon.—Captain Franklin states, that on the spot where he fixed his winter quarters on his last expedition, he observed that the magnetic needle oscillated whenever he approached it in a dress of water proof cloth, though it remained stationary when any of the party approached it in their ordinary clothes. He does not, however, offer a satisfactory explanation of this singular phenomenon.

Spots on the Sun.—Two remarkable spots have been visible, during the present week, on the sun's disc. One of them, towards the western limb, and

on that diameter of the sun which is parallel to the line of the sun's motion, is the same which, during the last revolution of the sun on its axis, measured about 19,000 miles in diameter.

Calculation of Circular Measurements.—It is the usual practice to estimate the pressure on the piston by the pounds on a square inch, though the pressure in pounds, on *a circular inch*, would be much more convenient for calculations relative to steam engines (and all other circular measurements); because all the vessels being cylindrical, the areas of the cylinders, in circular inches, can be obtained by merely squaring the diameter of the circle in inches: for example, a circle of 10 inches diameter contains $10 \times 10 = 100$ circular inches; but when we require the area in square inches, the square of the diameter must be multiplied by 0·7854; for thus, a circle of 10 inches diameter contains ($10 \times 10 = 100 \times \cdot 7854 =$) 78·54 square inches.

Flight of Birds.—Montagu is of opinion that many birds, when exerting themselves to the utmost, fly at a rate of not less than thirty miles per hour; even a sparrow has been calculated to fly at the rate of thirty miles in an hour; and Major Cartwright appears to have ascertained, by frequent experiments, that, during the same short period, the flight of an eider-duck is equal to ninety miles. The common kite (*falco milnus*) has been observed to pass, without great exertion, over a space of a quarter of a league in a minute; and it could fly with ease from Cape Pruth to the Land's End in a single day, were an instinctive tendency so to do combined with the physical power of which it is actually possessed. It appears probable, therefore, that the most extended migratory movement which any species is called upon to accomplish, may, in the greater number of cases, be performed in a couple of days; more frequently in the course of a few hours. My intelligent friend, Mr. Andubar, of Louisiana, whose magnificent collection of ornithological drawings has lately excited such general interest in Edinburgh, has communicated to me a singular fact relating to the powers of flight of the passenger-pigeon of America. He has shot that bird during his hunting excursion through the forests; and, on dissection, found its stomach full of fresh rice, which, to have resisted the digestive process, must have been swallowed *not many hours* preceding its death, but could not have been obtained within 800 miles of the place where it was killed.—*Wilson's Illustrations of Zoology.*

MINOR CORRESPONDENCE.

Sir,—I should be glad to be informed of the most simple and efficacious method of consuming smoke, in steam engine and other furnaces.—Your obedient Servant, A. F.—The plan of Mr. Brunton, described in Mechanics' Mag. vol. i. p. 121, and that of Messrs. Sarkes and Sons, noticed p. 250, vol. ii., have been generally esteemed the best. Our correspondent will also find some information on the subject in vol. iii. p. 315.

We find that our friend, Mr. Brew, of Ennis, is not a Quaker, as we supposed from the tenor of one of his communications, but one of that body of Quakers alluded to on a recent occasion, by Lord John Russell, in the House of Commons, as being comparatively numerous in Ireland, and who suffer many privations because of their religious objections to all oaths.

To the correspondent on the subject of Exchange—Yes.

Mechanics' Institution in Marylebone.—Sir,—It is a matter of surprise, that no attempt has been made to establish a scientific institution in that very populous neighbourhood, Marylebone and the Regent's Park. If, through the medium of your widely circulated publication, some spirited individuals should be induced to take the above into consideration, and call a meeting,—a circumstance "devoutly to be wished,"—an obligation will be conferred on myself and many others, who would support, yet have not the means of beginning, so desirable an object. Should this have the effect of arousing the inhabitants of this part of the metropolis to a desire of obtaining knowledge on the present approved plan of institutions, and a meeting should be called, by noticing the same, you will greatly oblige yours respectfully, R. M.—We shall be happy to promote the views of our correspondent by every means in our power. An institution in the populous neighbourhood of which he speaks, is certainly much wanted.—*Edit.*

NEW PATENTS.

Jonathan Brownill, of Sheffield, cutler, for an improved method of transferring vessels from a higher to a lower level, or from a lower to a higher level, on canals; and also for the more conveniently raising or lowering of weights, carriages, or goods, on rail roads, and for other purposes.—1st May—6 months to enrol specification.

James Palmer, Globe-road, Mile-end-road, rope maker, for certain improvements in the moulds, machinery, or apparatus, for making paper.—6th May—6 months.

Thomas Adams, of Oldbury, manufacturer, for certain improvements on trusses, or apparatus for the relief or cure of hernia or rupture.

INTERIM NOTICES.

As some words of a letter by "Mattens" are illegible, he is requested to send us a fairer copy. The differences he speaks of require elucidation.

We shall be glad to hear further from Mr. Vaughan.

Communications received from J. O.—G. H. Crefftwr—T. M. B.—Literary, Scientific, and Mechanical Institution of Newcastle-upon-Tyne—Mr. Saul—W. C.—R. P.—Mr. Jopling—W. L. L.—J. L.—Mr. Russel—Tim Allowswain—A Young Navigator—Umbra.

Erratum.—For "P. C." the initials affixed to the Description of the Portable Cramp, in our last Number, p. 328, substitute J. J.

☞ From the difference between lunar and calendar months, it necessarily happens that our monthly Parts of four Numbers each, which are usually transmitted to the country with the other Magazines at the end of each month, do not always contain the latest Numbers published. To remedy an inconvenience of this description, which exists at the present moment, we shall, next week, publish two Numbers at the same time (254 and 255), so that our country friends may have Part 64 by the Magazine parcels of June 30th, instead of July 31st.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster Row, London.

Printed by G. Duckworth, 76, Fleet-street.

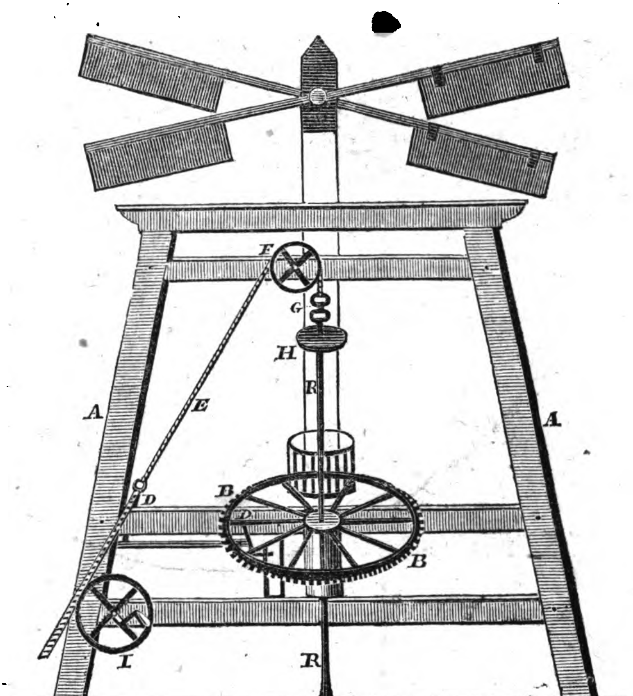
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE

Sup.—No. 254.] THURSDAY, JUNE 26, 1828. [Price 3d.

"Improvement and the world will expire together; and till that period arrives, we may plunder the mind, but can never exhaust it."—MACIRONE.

NEW BORING MACHINERY,

INVENTED BY MR. DIXON VALLANCE.



Sir,—It is well known to be heavy work for men to bore through hard stones at a great depth from the surface of the earth. Now in this age of invention and improvement, let us try, and, if possible, make boring a little more easy and expeditious.

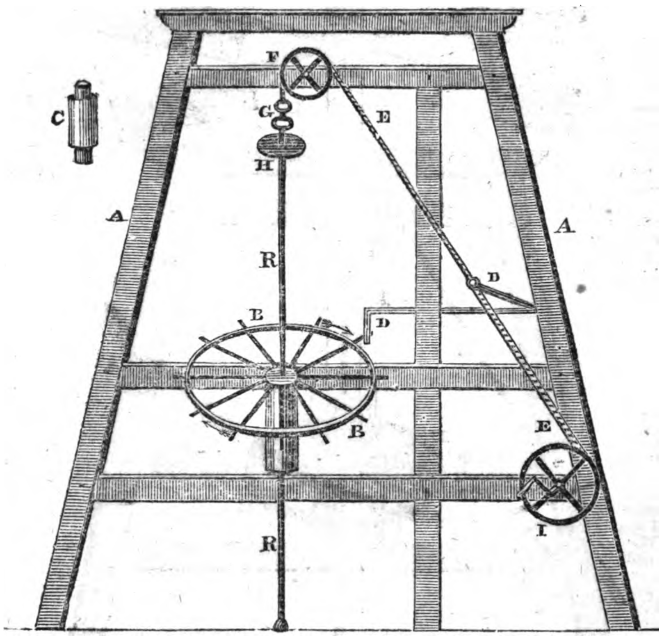
It appears to me that in many situations where that powerful agent, the wind, blows with a fair sweep, it might be advantageously employed for this purpose; since it would not only rival in performance the wonderful feats of the brownies and fairies of olden times, but, like them, refuse both wages and victuals.

I shall now give you an account of a boring machine, of which wind is to be the moving power, and leave it to those of your readers who are acquainted with the art of boring, to give us their opinions of it.

I would just premise, for the better understanding of the following description, that in boring through hard stones, the auger must have a slow rotary and a quick striking motion at the same time; that is, it should give ten, twelve, or fourteen

strokes for each revolution, more or less, in proportion to the hardness of the stone; while in boring through softer substances, or cleaning the hole, the rotary motion only is used.

A A, in the figure beneath, represents the frame of the machine; B B shows a horizontal wheel about three feet six inches diameter, with ten, twelve, or fourteen handspokes fixed in it; its axle or nave is one foot in length, and one foot diameter, and bound with a strong hoop of iron at each end; a cast iron bush passes through the axle of the wheel, and serves both for the wheel to turn round on, and for the boring rod to work up and down in. The boring rod R R is of an oblong square shape, two inches thick and three inches broad, where it works in the bush, and five or six feet long. G shows the bush (see also separate representation of it, fig. C). By turning round the wheel, the handspokes catch the crank D, which gives a striking mo-



tion to the rod. When boring through soft substances, or cleaning the hole, these spokes may be taken out. E E is a rope or chain to let down the rod as it works its way, four or five feet, when another length of rod is screwed to it, and so on, until the hole is deep enough. The rope or chain E is fixed to the crank D D, and passes over the pulley F, and is attached to the rod by a swivel at G, to prevent the chain from twisting. H is a weight fixed on the rod. I shows a crane for raising the rods. The arm of the crank next the wheel is perpendicular, and the arm that the chain is fixed to, horizontal. The arrows point the way the wheel turns.

The figure on the preceding page represents a wind-wheel attached, to drive the machine; both figures are in all other points the same.

I am, Sir,

Yours, &c.

DIXON VALLANCE.

Libberton, Lanarkshire.

PILE-DRIVING—COMPOSITION OF MORTAR.

Sir,—Your correspondent, Mr. M'Kinnon, charges me with dealing unfairly by him, in the remarks that I have made respecting the pile-engine question; with what justice, I leave to your readers to determine. At all events, I think he has now given me fair ground to retort the accusation. In the commencement of the discussion, he denied that the effective force of a falling body was doubled, by falling through a space of an inch and a quarter: because, forsooth, he had never heard of it before. A very sufficient reason, truly, why it should be "*a well known error*." He has not thought fit, however, to enlighten us by the information as to what space it must fall through to acquire a double force. In his last letter he assures us that his view of the question is "in accordance with EVERY treatise on mechanics which has appeared." Indeed! Two authors of no mean repute have been already quoted, whose views of the question are far different from those of Mr. M'Kinnon; but this he has forgotten. It is not to be expected, however, that any man who has read "EVERY treatise on mechanics which has appeared," can retain the whole in his head; it is, therefore, very excusable.

It would be very desirable to have a more detailed account of the experiments said to have been made in Portsmouth Dock Yard, and I hope some of your correspondents may be able to furnish one.

A little practical experience, in addition to his scientific acquirements, would have enabled Mr. M'K. to discover that many things admit of both maxima and minima, in practice, although in theory they do not; and that power and labour are not always synonymous. By an attentive re-perusal of some of the many "treatises on mechanics which have appeared," he would discover that the question, as I at first proposed it, viz. "*What is the* best possible height of a pile-engine, to produce the greatest effect with the least loss of time and labour?" is not the same as asking, how high must the pile-engine be, to produce the greatest momentum in a given time? as he appears, from his answer, to have considered it. His surprise at my asking the question may possibly be increased, when he finds that it has been proposed (in the same words), and engaged the attention of several very able and scientific men, years ago. Having framed the question differently, Mr. M'K. finds fault with the word "*purposes*." The word *use* would, perhaps, have been more correct; but I almost fear to suggest such an alteration, lest it should again subject me to the charge of "*having a knack at shifting*," and writing nonsense. Although so much has been written on the subject, the carpenter, I fear, may yet, among these conflicting opinions, have some difficulty in making his calculation; and therefore I recommend him to make some experiments, and judge for himself which theory is the most correct.

And now, Sir, having had so much about *pile-driving*, suppose I reverse the question, and request the carpenter, or some other of your correspondents, to favour us with a plan of the best engine for drawing them out; with such practical observations as they have had an opportunity of making, upon the force found necessary to be employed to extract piles of different sizes out of different descriptions of soils, and in different situations.

I intended to offer you some observations upon the composition of mortar; but as it would be taking up too much of your valuable pages, I must defer it. "E. B. C. G.'s" plan, in your 247th Number, of using coal ashes instead of sand, is a very excellent one, where that material is to be had; but that is not the case in all situations.

I am, Sir, &c.

GLEVUM.

June 7, 1828.

DIFFERENCE OF LONGITUDE IN TIME.

Sir,—I had thought of not troubling you any more on this subject; but on a second consideration, must beg your insertion of the following, which shall certainly be my conclusion of it.

In the first place, with respect to the reply of Mr. Henry H., page 77, I beg leave to inform that gentleman that I cannot thank him for his supposed corrections of my calculation; as I think it must be abundantly evident to every candid mind acquainted with decimals, that I meant to give the result to the nearest second only, and consequently took a surplus of little more than one-fifth of a second. And for the second meridian, Mr. H. has taken the mean right ascension at mean noon, the same as that for the meridian of Greenwich. Where did he find it so expressed in my letter? Who that is the least acquainted with subjects of this nature, could suppose the right ascension to be the same at the time of mean noon under different meridians? On this, therefore, another word would be superfluous. Permit me, however, to take this opportunity of correcting an error which there *was* in my first communication, and which escaped the notice of Mr. H., notwithstanding his minute examination. I had, by a mistake for which I cannot easily account, stated the mean right ascension for the meridian of Greenwich, on the given day, at 23 h. 11 m. 58 s., instead of 23 h. 6 m. 33·22s.; this being rectified, the sidereal time at Greenwich would be 5 h. 41 m. 52·99s.; and at the second meridian, the mean right ascension at mean noon was 23 h. 5 m. 18·95 s., and the sidereal time there, 13 h. 14 m. 2·99 s.; making a difference in sidereal time of 7 h. 32 m. 10 s.,—the same as the difference in mean time.

With respect to the reply of Astro Solis, page 187, I would just remark, that he has again missed the principles of the subject altogether. He has spoken only of time elapsed between the transits of the sun over two meridians, &c.; all which is sufficiently answered, as it were by anticipation, in that part of my letter, page 151, beginning, "If we required the time elapsed," &c. But the *difference of longitude* of places on the surface of the earth is expressed in time, at the rate of 15 degrees to one hour in every species of time, and denotes the difference between those times under the two meridians, at any *absolute instant*;—take, for example, the instant in which the reader pronounces the word *now*. That is to say, the difference between the times shown by an accurate chronometer kept under each meridian is the same precisely, whether the chronometers keep mean or sidereal time; and there will be just the same difference between the variable or apparent times: for whatever be the rate of variation, it is obviously the same at *all places*, in the same *absolute instant*.

Astro Solis states, that although *apparent* time is used for finding the difference of longitude on the earth's surface, it should, notwithstanding, be converted into mean time; and he *presumes* that *Dr. (then Mr.) Brinkley* made use of such a method; indeed, he further on says, he has *no doubt* of his having done so. Now, Sir, I happen to *know* that *Mr. Brinkley* did *not* reduce to *mean time*, but that he found the difference between the *apparent* times only. It will, perhaps, be useless to make this assertion to Astro Solis, since he has *no doubt* of the contrary. I would, however, beg to refer him to "Vince's Astronomy," vol. i. pp. 538—559, of the first edition.

With regard to this point, also, it behoves all ship-masters, and nautical persons, to look well to it; for if the statement of Astro Solis be correct, scarcely any of the longitudes found from the lunar distances given in the "Nautical Almanac" have been accurately determined!

By way of conclusion to the subject, I hope, Sir, you will do me the favour to insert the following examples, which, to the generality of

your readers, will, perhaps, be more satisfactory than any reasoning on the principles. I have taken the examples for different times of the year, for the sake of variety in the equations, and have used the meridian of Greenwich in every example, for the greater simplicity in the calculations.

Our *first Example* shall be on the 20th of February, 1827, with respect to Greenwich, and a place, P, in 120° West longitude.

	ho.	m.	s.
1827, Feb. 20, mean noon at Greenwich, or mean time, Feb. 19 .	24	0	0
Equation of time at apparent noon, 20th ..		—14	6
Daily variation of the equation is — 6 s.; hence, proportional part for —14 m. 6 s. is	—	—	0
Hence, apparent time at Greenwich	23	45	54
Sun's true right ascension at apparent noon, 19th	22	8	53
Daily increase, 3 m. 50 s.; therefore proportional part for the apparent time	0	3	47·7
	21	58	34·7
At P, mean time, Feb. 19	16	0	0
Equation of time at apparent noon at P ..	—	14	10
Proportional part for 16 ho. is		+	4
Hence, apparent time at P	15	45	54
Sun's true right ascension, apparent noon at P	22	10	9·6
Proportional part for apparent time is		2	31·1
Hence, sidereal time at P	13	58	34·7

In the above example it is immediately seen that each of the three differences between the same species of time is precisely equal to eight hours, which is therefore the proper time for stating the difference of longitude, whatever species of time we regard; and it must obviously be reduced to angular measure, at the rate of 15 degrees to an hour, to obtain the longitude 120°, as we at first assumed. In the two following examples I omit, for the sake of brevity, the intermediate steps of the reductions.

Second Example, 4th September, 1827, P being 90° *E. L.*

	ho.	m.	s.	diff.
Mean time at Greenwich	0	0	0	6 ho.
Ditto at P	6	0	0	
Apparent time at Greenwich	0	0	56	6 ho.
Ditto at P	6	0	56	
Sidereal time at Greenwich	10	51	19·1	6 ho.
Ditto at P	16	51	19·1	

Here, again, the longitude in time is 6 hours in every species.

Third Example, 21st December, 1827, P being 60° *E. L.*

	ho.	m.	s.	diff.
Mean time at Greenwich	0	0	0	4 ho.
Ditto at P	4	0	0	
Apparent time at Greenwich	0	1	50	4 ho.
Ditto at P	4	1	50	
Sidereal time at Greenwich	17	57	6.3	4 ho.
Ditto at P	21	57	6·3	ditto.

The longitude, in this case, also may be expressed by four hours in every species of time; and I trust that the truth of the case must be fully evident to every candid inquirer, under all circumstances of time and place. I therefore take leave of this subject, but remain,

Sir,

Ever yours, &c.

VECTIS.

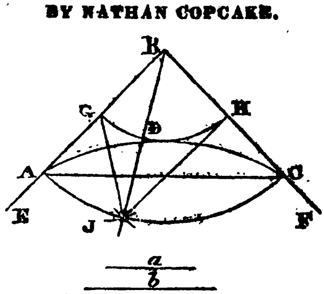
THE MATHEMATICAL PROBLEM (VOL. VIII. P. 448), AND AS ENLARGED BY "G. S." (VOL. IX. P. 237).

We are informed by an esteemed mathematical friend, that this pro-

blem as originally stated (vol. viii. p. 448), was only an old friend in a new and not improved dress; and that it was first proposed by a very ingenious mathematician, Mr. Smith, of Leith, and published in the second edition of Brown's Trigonometry, by Mr. John Wallace, then a teacher of mathematics in Edinburgh. The chief fault of the problem, in its altered shape, was, that it did not state that the three lines were straight lines, and of a given magnitude. It will be no more than justice, therefore, to the original proposer of the question, to show how susceptible it is, when properly stated, of a perfectly geometrical solution. We might, for this purpose, insert that which was given by Mr. Wallace, in his edition of Brown's Trigonometry, and which corresponds very nearly with one which has been sent us by Mr. Mackinnon; but as that can be referred to by many of our readers, we prefer giving another, with which we have been furnished by Nathan Copcake, in which the same results are obtained by a different mode of construction. Mr. Copcake will perceive that we have made some alterations in the terms of his demonstration; they were rendered necessary by what appears evidently to have been an oversight on his part.

Solution of the Problem in its restricted form.

BY NATHAN COPCAKE.



Problem:—To construct an isosceles right angled triangle, and to find a point within it; such, that if three straight lines be drawn from that point to the three angles, these three straight lines may be respectively equal to three given straight lines.

Construction.—Let a, b, c, be the three given straight lines. Draw B E, and from the point B draw B F at right angles to it (Euc. b. i. p. 11.) From the point B, with the distance B D$=a$, describe the arc G H, cutting B E, B F, in G H. From G, with the distance G J$=b$, describe an arc at J, and from H, with the distance H J$=c$, cross the former arc at J; then from the point B draw E J through the intersections of the arcs at J, and crossing the arc G H at D. From B, with the distance B J, describe the arc A J C, cutting B E, B F, in A, C. Draw D A and D E, which are respectively equal to G J b and H J$=c$. Join G J and H J. Because B G$=$B D, and B A$=$BJ, and also the angle A B J is common to the two triangles G B J and A B G, hence (4 and 1st Elem.) A D$=$G J: exactly in the same way it may be demonstrated that J H$=$D C $\therefore$ in three straight lines B D, D A, and D C, are respectively equal to the three given lines, a b c.

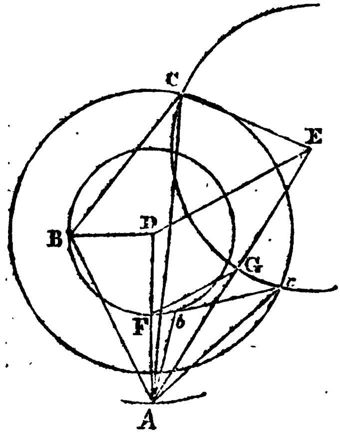
Solutions of the Problem in the enlarged form proposed by "G. S."

BY VECTIS.

Construction.—Take any point D, from which, as a common centre, with radii equal to the three given distances, describe the circles or arcs B F, C c, and A; assume any point in A, and join A D; on which describe a triangle D A E similar to the given triangle. Draw F G parallel to D E; and on E as a centre, with radius E G, describe the circle C G c; to the point of intersection C, draw A C; make C A B$=$D A E; join B C, and A B C shall be the required triangle, and D the required point.

Demonstration.—Draw E C, B D. By construction, the angle B A C$=$ D A E; take away the common angle D A C, and D A B$=$C A E; and because F G is parallel to D E, D F : E G :: D A : A E, $\therefore$ B D : C E :: D A : A E; and conse-

quently the triangles D A B, E A C, are similar (Euc. vi. 7), provided



that A B D, A C E, are always at the same time obtuse, right, or acute angles; which is here sufficiently manifest, taking B and C both alike on the *concave* or on the *convex* parts of the respective circles. Hence, A B : A C :: A D : A E, and these contain equal angles; ∴ A B C is similar to D A E. But D A E is similar to the given triangle; ∴ A B C is also similar to it, and contains the point D at the given distance from each angle.

Remarks.—Since A C may be assumed as *any* line touching the circle C G, and A B the corresponding line touching the circle B F, it is manifest that the circle C G is the *locus* of the angle at C, and ∴ its points of intersection with the circle of distance C *e* will fulfil the conditions. Consequently, A *b c* is another position: but here the point D falls *without* the triangle; and it is obvious that with some particular data, one position only would be possible; also, if the circle C G falls wholly without the circle C *e*, the problem fails; that is, the requisites would not be possible with the data.

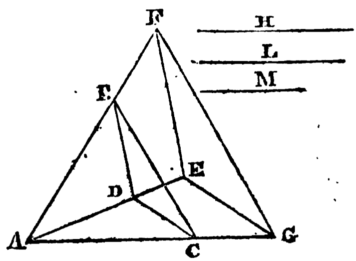
The point A may be assumed in either of the other circles of distance, and the construction would be similar; but it is most convenient when the angle at A is acute.

It may not be improperly mentioned here, that the proposition of Euclid, above stated, according to its usual enunciation, comprehends an absolute falsehood; to remedy which, instead of the words, *and the sides about two other angles proportionals*, it should be, *and the homologous sides*, &c. This error was, I believe, first discovered by Mr. J. Young.

BY MR. J. BADHAM,

Pupil at York House Academy, Kentish Town.

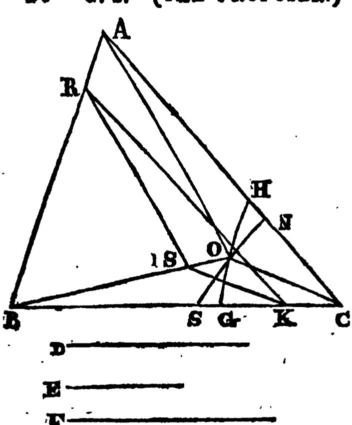
[A remarkable specimen of early mathematical attainments, which is alike creditable to our young correspondent and to his instructors.]



Let A B C be the given triangle, and H L M the three given straight lines; it is required to construct a triangle similar to A B C, and to find a point within the required triangle, such that if three straight lines be drawn from that point to the three angles of the required triangle, these three straight lines may be respectively equal to three given straight lines. Find a point D within the given triangle A B C (Prob. 31, "Thomas Simpson's Geometry"), such that A D, D B, D C, may be proportional to H, L, M; and in A D or A D produced, take A E equal to H; through the point E draw E F parallel to B D, to meet A B produced in F, and draw E G also parallel to D C, to meet A C produced in G, and join F G. A F G is the required triangle, and E the required point. Because E G is parallel to D C, A G : A E :: A C : A D; and because E F is parallel to

B D, A F : A E :: A B : A D (Elem. ii. b. 6); therefore, (Elem. xi. b. 5), A G : A F :: A C : A B, and (Elem. vi. b. 6) the triangle A F G is similar to the triangle A B C. Next, A D : D B :: A E : E F; but A D : D B :: H : L; therefore, A D : E F :: H : L; but A E is equal to H, therefore, E F is equal to L. In the same manner, it may be proved that E G is equal to M; therefore the triangle A F G has been constructed similar to A B C, and a point E has been found, such that E A, E F, E G are equal to H L M.

BY "G. S." (THE PROPOSER.)



Let A B C be the given triangle; D, E, F, the three given straight lines. It is required to construct a triangle similar to A B C, and to find a point within the required triangle, such that if three straight lines be drawn from that point to the three angles of the required triangle, they may be equal to the three given straight lines D, E, and F.

Divide B C in G, so that B G : G C :: D : E; then, if D and E are unequal, ∴ BG and GC are unequal. If from the points B and C there be inflected any other straight lines in the ratio of B G to G C, the *locus* of their point of concourse will be in a circle given in position and magnitude (Prop. xii. b. iii. "Leslie's Geometrical Analysis"). Let G O H be the circle. Again, if E and F be unequal, and A C divided in N, so that C N : A N :: E : F, the *locus* of the point N will also be in a given circle, S O N. Let the two *loci* intersect each other in O; join B O, C O, A O; then, by construction, B O, C O, A O, are in proportion to D, E, and F. In B O take B S = D, and draw S R, S K, parallel to AC, and O C, meeting the sides of the triangle A B C in R and K; join R K. R B K will be the triangle required, and S the required point.

Because OC is parallel to SK, B C : BK :: BO : BS, for the same reason B A : B R :: B O : K S ∴ by equality B C : B A :: B K : B R ∴ (Euclid vi. and 6), the triangle R B K is similar to the triangle A B C. Again, by parallels, B O : O C :: B S : S K; but B O : O C : D : E ∴ B S : S K : D : E; and B S, by construction, was made = D ∴ S K = E. In the same way, it may be demonstrated that S R = F ∴ &c.

Cor.—If D = E, the *locus* of the point G will be in a straight line, bisecting B C at right angles, &c.

As the two circles may intersect one another in two points, if the required point is not restricted to be within the required triangle, the problem will evidently admit of two solutions.

REPLY OF "F." TO "Q. E. D."
(NO. 253, P. 345.)

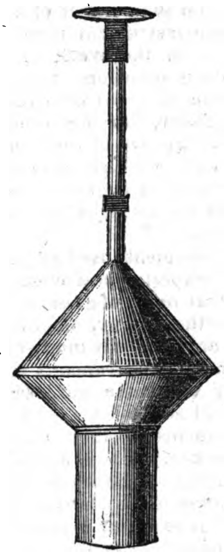
Sir,—The defence of "Q. E. D." is even more absurd than his solution. I will prove this in a few words. He persists in saying that the three straight lines are of given *magnitude* and *position*; of course the three angular points must be *determined*, and the triangle which should pass through these points is also *determined*. I ask, therefore, how "Q. E. D." can produce the rectangle and isosceles, to resolve the question? "Q. E. D.'s" geometry is of quite a new sort; and I admit that no one can accuse him of being "on the side of Mr. Russel and the Old Light System."

F.

ON THE CONSTRUCTION AND USE OF THE SACCHAROMETER, AND FERMENTING MALT LIQUORS.

BY THOMAS SADDINGTON,

Author of "Plain Directions for Family Brewing."



Sir,—Having paid considerable attention to the construction and use of the Saccharometer, as connected with private or family brewing, I have drawn up the following observations for your Magazine; and should they meet with your approbation, I intend to renew the subject on some future occasion. I remain,

Sir, yours, &c.

T. SADDINGTON.

8, *Upper John-st.*, *Commercial-road*, *May* 8, 1828.

The term saccharometer is derived from the Latin word *saccharum*, signifying sugar, and *metron*, a measure, because liquids imbibing a portion of sugar, or saccharine matter, are specifically heavier than water, in proportion to the quantity of sugar they contain; and it is the prerogative of this instrument to measure the quantity of sugar contained in any given quantity of liquid.

The saccharometer, or sugar measurer, is generally used by brewers to regulate the density and comparative strength of malt liquor, and to ascertain the progress of attenuation while the worts are in a state of fermentation. The thermometer for taking the different heats, and the saccharometer for density, may be considered as indispensable instruments in a well conducted brewery; for without such necessary assistants, the process of brewing must be carried on with undefined progress and uncertain results. These remarks will apply with equal propriety to the private family, who brew two or three bushels at a time, as they do to the public brewer, who mashes probably fifty or one hundred quarters of malt at each brewing. Every person who brews his own malt liquor always feels a secret pleasure in being able to produce his ale and table beer of an uniform strength and of an uniform flavour, which can only be done by a judicious application of the thermometer and saccharometer.

Although the use of the saccharometer is generally confined to the purposes which its name imports,—to indicate the presence of sugar in any liquid,—yet the principle of it is employed by the practical chemist in trying the strength of acids and other chemical fluids; and also by the bleacher, in trying the strength of his solutions. It is also of great importance to the tanner; for, by the assistance of this instrument, he is enabled to judge when his tan-pit is sufficiently charged, and adds or withholds his ingredients as necessity requires, whereby he avoids a needless waste of valuable materials. An instrument on the same principle is extensively used by distillers, and the officers of His Majesty's revenue, to obtain the strength of spirituous liquors, and to detect the presence of water, when it has been clandestinely adulterated. It is then termed hydrometer, from *hudor*, signifying water, and *metron*, a measure, viz. a water measurer; because it is for ascertaining the rarity of liquids lighter than water, and,

as before observed, for detecting the presence of water in those liquids; whereas the saccharometer is for ascertaining the density or weight of liquids heavier than water. The weight of one gallon of highly rectified alcohol is 8 lbs. 4 oz.; distilled or rain water, 10 lbs.; and very strong ale wort, 11 lbs., imperial measure. If we, then, assume a fixed point of rarity lighter than water, as, for instance, highly rectified alcohol, as a standard of gravity, and apportion our weights in an increased ratio to the decreased rarity, until we arrive at the specific gravity of distilled water, which is generally assumed as the standard between rarity and density; and then continue increasing our weight for the increased density of strong ale wort; we should then have the acetometer for the chemist, the chlorometer for the bleacher, the barkometer for the tanner, the hydrometer for the distiller, and the saccharometer for the brewer, all combined in one plain simple instrument. And here I would observe, that such an instrument, to answer all these various purposes, must be made of glass, as the action of acid would soon destroy and render useless any instrument made of metal.

A very pleasing, simple, and easy experiment may be made, to illustrate the principles of the saccharometer in liquids heavier than water, with a common glass bottle, or wine decanter.—Dissolve half a pint of common salt in one quart of water; then fill the decanter quite full with common cold water, and weigh it in a pair of regular shop scales; then pour out the water, and fill it again quite full with the salt water, and, weighed in the scales as before, you will find it to be considerably heavier, although the decanter contains no more liquid than it did with the common water.

The same experiment may be tried with either moist or lump sugar, ale, table beer, porter, milk, sea-water, or any other liquid heavier than common water, and the same result will take place.

It would be infringing too much on your pages to enter minutely into these experiments; I shall, therefore, in the present paper, confine my observations more immediately to the process of brewing, and the construction of a cheap saccharometer to be used in private families, with common avoirdupoise weights, and a Table, calculated to indicate the density from the number of drachms weight the instrument is capable of supporting in the wort. And, on some future occasion, I intend to explain the mode of constructing a saccharometer, to be used with weights expressive of the number of pounds density; and also another instrument, with a graduated stem, indicating the density of the wort by inspection.

The instruments used by the practical and experimental chemist and bleacher are made of glass; and those used by the tanner, distiller, and brewer, are generally made of brass. There are also instruments made in glass for the same purposes; but they are ill adapted for the brewery, in consequence of their liability of being broken. They are also divested of that accuracy which is so essentially necessary for those whose object it is to make a gain of their employment.

Before I enter more fully into a description of the instrument, and the manner of calculating the weights to be used with it, it will be proper for me to advert to a small Treatise, entitled, "Plain Directions for Family Brewing," which I wrote about five years ago (published by Mr. Fairburn, Broadway, Ludgate-hill),* and in which publication I gave a very particular description of a cheap saccharometer, and also an engraved representation of it, and pointed out the advantages and utility of the saccharometer to private families brewing their own malt liquor. My reason for now referring to that publication is to correct the data there laid down for calculating the proper weights to be used with it. Since the publication of that Treatise, the Legislature have made an alteration in the public weights and measures of this country. The passage I particularly wish to call the attention to is on the 20th page, and is as

follows:—"One cubic foot of pure water is equal to 1000 ounces; one gallon of water, beer measure, is equal to 282 cubic inches. Then say, as 1728 cubic inches in one foot is to 1000 ounces, the weight of pure water, so is 282 cubic inches in one gallon to 163 ounces 3 drachms, the weight of one gallon of pure water, or equal to 10 pounds 3 ounces. A barrel of water, containing 36 gallons, beer measure, will weigh 367 pounds 3 ounces."

I have already observed that, since the publication of this Treatise, the Legislature have made an alteration in the weights and measures of this country, which are now termed imperial, wherein the standard measure for liquids is defined, for the gallon, to contain "10 pounds, avoirdupoise weight, of distilled water, weighed in air at the temperature of 62 degrees of Fahrenheit's thermometer:" so that you will perceive, from these remarks, the imperial gallon weighs 3 ounces less than the old gallon beer measure; and from this definition it will appear that a barrel of 36 gallons, imperial measure, will weigh 360 pounds, being 7 pounds less weight than the old beer measure.

The description of the saccharometer given in the pamphlet before referred to being concise and sufficiently explicit, will answer my purpose on the present occasion, and I shall now copy another extract from it, page 19, as follows:—"This instrument may be made either of copper or tin, in the shape of two concave hemispheres, soldered together, similar to the ball attached to water-cocks to turn off the water from the cistern when it is full. They may also be made of an elliptical or oval form; or in a still less expensive manner, in the shape of two small funnels, or hollow cones, with the mouth or base of one inverted on the other, and soldered together: either of these forms will be equally accurate.* The most convenient size for the ball of the instrument will be about three and a half or four inches diameter, and a proportionate depth; about one inch of the under part of the ball, or point of the cone, must be cut off, and have a bulb attached to it, about one inch and a half or two inches diameter, and about one inch and a half or two inches deep, similar to the lid or top of a tea cannister, for the purpose of containing the shot to poise the instrument in water. On the top of the ball must be fixed a tube, or hollow stem, about four inches long, furnished with a cap, to take off occasionally. On the top of the cap must be placed a small dish (similar to a small scale-pan for weighing gold coin), to hold the weights when the instrument is used. A small brass or copper ring, about one-eighth of an inch wide, must be fixed on the stem, at one inch above the ball, to be called the gauge point. The instrument must be hollow, from the top to the bottom of it, and loaded with small bird shot, by putting it down the tube or hollow stem, until it sinks to the gauge point. Then weigh the instrument out of the water, from which a Table, from the following *data*, must be calculated for ascertaining the specific gravity of malt liquor."

The *data* to which I here allude were grounded on the old measure; but I shall here furnish the proper data for calculating the proper weights to be used with the instrument, from the new or imperial standard of weights and measures.

The Legislature having fixed the weight of the imperial gallon of water to be exactly ten pounds, the calculations for the proper weights are rendered very easy.

We will suppose the instrument, when sufficiently loaded with shot, to be immersed in cold water, at a temperature of 60 or 62 degrees, to sink it to the middle of the gauge point on the stem, and then weighed out of the water, and to weigh 10 ounces 10 drachms. Then say, as 10 ounces 10 drachms, the weight of the instrument, is to 360 pounds, the weight of one barrel (of 36 gallons) of water; so is 1 drachm to 2 pounds 1 ounce 14 drachms, the

* See the drawing prefixed to this article.

weight of saccharine matter contained in 1 barrel of 36 gallons, when the instrument is loaded with 1 drachm weight in the cup on the top of the stem. Then proceed in the same manner to form a Table, to be used with common avoirdupoise weights of ½ drachm, 1 drachm, 2 drachms, ¼ ounce, ½ ounce, and 1 ounce. For this instrument, the weights would indicate as follows:—

Table.

Drachms	lbs.	oz.
1	2	1
2	4	3
3	6	5
4	8	7
5	10	9
6	12	11
7	14	13
8	16	15
9	19	—
10	21	2
11	23	4
12	25	6
13	27	8
14	29	10
15	31	12
16	33	14

This method for obtaining the density of any liquids heavier than water is very simple, and may be rendered sufficiently accurate (rejecting the ounces) for general purposes in a family brewery. When the yeast is added to the wort, it is termed Pitching, or Pitching Density; and when it is drawn off into store vats, or tunned into casks, it is termed Cleansing, or Cleansing Density. It will afford much amusement, as well as information, to keep a regular journal of the density of the worts and progress of attenuation, or fermentation, in every brewing.

(*To be continued.*)

REMARKS ON MR. EVANS'S AIR-PUMP.

Sir,—I read with considerable attention the account of the improved air-pump, contrived by Mr. Evans, of Swansea, especially when I beheld where he resided, as being indicative of a spirit of inquiry being about commencing in that hitherto neglected portion of Great Britain—Wales.

I am sorry, however, to inform him that the design is not so new as he imagines; for I find that nearly all the early air-pumps were constructed on this principle, but were found very inconvenient, on account of their requiring a stop-cock to be opened and shut every time the piston was raised and depressed, until the required vacuum was produced. Now, it will be obvious that such an arrangement must be troublesome, especially if we wish to try some experiments with expedition. Mr. Evans's apparatus has this defect; which, however, may be remedied by the following simple appendage. Let a cock be placed on either side of the cylinder, say about the pipe which connects it and the receiver, furnished with a round head, similar to a pulley, instead of the ordinary square head; forming, in fact, a cylindrical cock, which must of course be the size of the cylinder, in order to render it perfectly air-tight. On the outer edge of this cock is fixed a hook, through which a wire is passed, one end of which is attached to the piston near the handle, and the other is furnished with a small obstruction, the nature of which will be presently explained. If we now wish to exhaust the receiver, we draw out the piston, and the rod of course follows; when it is nearly drawn out to its full extent, the obstruction, as above intimated, comes in contact with the hook; and the piston, being drawn to the end, also exerts its force on this obstruction, which moves this hook along with it, and as such, turns the cock. The piston is then depressed, and the air allowed to escape; when, just before it arrives at the farthest extremity, this hook meets with another obstruction, placed nearer the handle, which turns the cock on; the piston is again drawn out, the cock closed as before, and so on alternately.

It will be obvious, that an appa-

ratus similar to Mr. Evans's, with this addition, may be made at a comparatively small cost, so that there will not be quite so much reason for the complaints of the great expense of air pumps; the commonest of which cannot be purchased for less than ten pounds.

The most perfect air pump of the present day is undoubtedly that contrived by Mr. Stiles, which performs exactly twice the work of a common double-barrelled apparatus, and is not so defective in the principle on which its valves are constructed. A full and accurate account of this pump, illustrated with plates, will be found in the London Journal of "Arts and Sciences" for April.

I remain, Sir,
Your obedient Servant,
JOHN DAVY.

Duncan-place, Hackney,
May 26th, 1828.

NOTICE OF THE INVENTIONS OF THE MESSRS. HART, OF GLASGOW, AND OF MR. R. C. CLINT'S CLAIM TO THE INVENTION OF BALANCE MASTS.

Sir,—At page 204, vol. ii. of the Magazine, there is an account of the annual distribution of rewards by the Society of Arts; the seventeenth in the list is to Mr. R. C. Clint, for a balance mast, the large silver medal, or twenty guineas. Now, Sir, I will not trouble you with any remarks on the practical utility of this invention, my object being to show that it did not originate with R. C. Clint. The invention was that of Mr. R. Hart, of Glasgow; from whom Clint borrowed it. To prove the correctness of my assertion, it will be necessary to advert to the cause which gave rise to the invention. Mr. R. Hart, and a few friends, had a small pleasure boat on the Clyde, in which they took excursions down the river when the wind was favourable. Now, as every person knows who is acquainted with the navigation of the river Clyde, that the adjacent country on each side is very elevated, and interspersed with valleys; which occasion frequent and sudden squalls, to the great danger of small boats. Mr. R. Hart conceived, that he could to a certain extent remedy the evil, by a balance mast, constructed in such a way that it would give way to any sudden gust of wind, and again resume its former position when the wind abated. Mr. Hart did not attach any great degree of merit to the above invention; and the boat having been shortly after sold, the invention was never carried into effect. The Messrs. Harts being well known for their extensive knowledge in all departments of science, their residence became a rendezvous in the evenings for many who were desirous to *profit* by their conversation; *Clint was one of the number*, and here it was that he first heard of a balance mast. Mr. Clint was at that time a seal engraver in Glasgow, but shortly after left that city.

I could fill the Magazine, if I were merely to mention the different inventions of the Messrs. Harts; I will not, therefore, make the attempt; I may, however, for the encouragement and amusement of my brother mechanics, mention a few that occur to me at present. The first, though not properly an invention, is a clock of novel construction; at every hour, when the clock is about to strike, there are two little fellows who make their appearance, each with a hammer in his hand, with which they strike the bell alternately, till they have completed their job, when they retire.* They have also an excellent Newtonian telescope, seven or eight feet focus, the stand of which is on a new construction, by means of which greater stability is obtained than by any other construction with which I am acquainted. The next is a small steam engine, upon the Bolton and Watt principle; but the mechanism of which is entirely

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* The clock of St. Dunstan's, Fleet-street, has long had to boast of two bellmen of the same description; and on the Continent such appendages to clocks are common enough.—EDIT.

different, and more compact than in any model I have ever seen of the same power. The above things were entirely of their own construction; which appears the more astonishing, when we consider that their occupation is in no way connected with the mechanic arts. It was Mr. J. Hart that first suggested the lighting of the dials of steeple clocks with gas; and it was he who planned and superintended the execution of the same in the Tron Steeple, Glasgow. While Mr. J. Hart was engaged in the drawing of a parabolic curve to assist the workmen in forming the reflector for throwing the light upon the dial, he discovered a method of not only forming a parabola, but all the other conic sections, and of illustrating their various properties, by means of small slips of paper, on which he drew parallel, converging, or diverging lines; these again, being cut and folded in a particular manner, produced the different curves. The same principle is also applicable to the illustration of various optical instruments. I shall just notice one more design of Mr. J. Hart's: it was a gas lamp for the Trades Hall, in Glasgow, in which the arms of the different incorporated trades were blended in such a way, as to give the whole an exceedingly beautiful and chaste appearance; but I regret that this elegant design was mutilated in the execution (in Mr. H.'s absence), by the officious interference of an ignorant deacon.

By giving place to the above, you will much oblige

Your obedient Servant,

A. MACKINNON.

NEW PUBLICATIONS

Connected with the Arts and Sciences.

The Painter's, Gilder's, and Varnisher's Manual. New Edition, considerably enlarged and improved. 215 pp. 18mo. Knight and Lacey.

The author of this little volume—himself evidently a practitioner of the arts about which he writes—has contrived to embody within a small compass a large body of most useful information. It may not possibly comprehend all the instruction requisite to the formation of a good painter, gilder, or varnisher; but it contains, at least, nothing but what every mechanic of this class will be benefited by knowing, and much which the most able and experienced among them have never before heard of, or known before very imperfectly. The tools and apparatus employed in painting, gilding, and varnishing, are first described; colours, oils, varnishes, polishes, and gilding materials, are next treated of, each very minutely; and, after these preliminary sections, we are introduced, in succession, to the practice of painting, the practice of varnishing and polishing, and the practice of gilding. Two or three supplementary chapters are devoted to the analogous subjects of lacquering, bronzing, japanning, foils, &c. We have then a large collection of "Miscellaneous Subjects and useful Receipts;" and, in conclusion, an interesting treatise on the "Diseases and Accidents to which Painters and Varnishers are particularly liable;" for the information under which head the author states he is indebted to "a medical gentleman, of extensive acquirements and great experience." The style of the author is plain and homely; but it will not, on that account, be the less relished by practical men. As we have already hinted, the information he furnishes is frequently as new as it is valuable; nor can we better justify the good opinion we have expressed of the work, than by quoting some examples of its merit in this respect.

"*Madder lakes*—or, as they are sometimes called, *madder carmine*—are nearly as costly as cochineal lakes, and not so *much* inferior as is generally supposed. They are very durable, and have the peculiar merit of long retaining an appearance of great freshness. Madder being itself abundant and cheap, the costliness of madder lakes has been hitherto entirely owing to the extremely tedious and complicated methods pursued in the manufacturing of them; but, in consequence of certain scientific researches recently entered into by Messrs. Colin and Roubiquet, (see Annales de Chim. March 1827,) so much light has been thrown on the subject, that the same results may now be obtained in three or four hours only, which formerly required several successive months; and that, too, in a very simple manner. 'The manipulations,' says Messrs. Colin and Rou-

biquet, 'are so easy in practice, that it is in every person's power to undertake them; and in a little time, we have no doubt, the use of these lakes will extend to the commonest objects.'

"The new mode consists in mixing one part of madder with four parts of water, leaving it to macerate for ten minutes only, and then submitting it to a powerful pressure, till nearly every portion of liquid is squeezed out. Three times this process is repeated; and to the washing liquor preserved in each instance, there is added 5 or 6 parts more of pure water, and half a part of pounded alum. The mixture is then allowed to macerate for 2 or 3 hours, in the heat of a water bath, and stirred occasionally with a spatula. It is next strained through a fine cloth, and afterwards filtered through paper. A dilute solution of crystals of soda is finally added, when a precipitate is formed, which is the colouring matter wanted. Messrs. Colin and Roubiquet recommend that the dilute solution of crystals of soda should be divided into three portions; by which means three precipitates will be obtained, decreasing successively in colour and richness."

"*New Brown, discovered by Mr. Hatchet.*—The celebrated chemist, Mr. Hatchet, has suggested to painters that a simple brown colour, far superior in beauty and intensity to all the browns, whether simple or compound, hitherto known, may be obtained from the prussiate of copper (a combination of prussic acid with copper). The following is the process which he recommends:—Dissolve the green muriate of copper in about ten times its weight of distilled or rain water, and add a solution of prussiate of lime, until a complete precipitation is effected. The precipitate is then to be washed with cold water, filtered, and set to dry in the shade."

"*Adulterated Cobalt.*—A portion of Prussian blue is frequently mixed up with the genuine cobalt; and Prussian blue has been even prepared in such a manner as to be passed off for cobalt, without containing a single particle of that ingredient. The property, however, which Prussian blue possesses, of being discoloured by alkalis, furnishes an easy security against any imposition of this sort. Immerse a piece of the suspected article in clarified lime-water for about an hour; if the water has then assumed a citron hue, and there is an ochrous deposit at the bottom, it is a certain proof of the presence of Prussian blue."

"*Manufacture of Spirit Varnishes.*—It is a common practice in the manufacture of spirit varnishes, to mix glass or sand with the gum or resin, for the purpose of enabling the alcohol to penetrate more readily into all parts of the mass. M. Ferrari, however, recommends (Giornale de Fissica, IX. p. 36) that in place of those substances, a coarsely powdered charcoal should be used: for the glass or sand generally tends to aggregate the gum or resin at the bottom of the vessels, and to protect it from the solvent; whilst, on the contrary, the charcoal rather tends to raise and divide it. The most advantageous proportion appears to be one ounce of charcoal to one pound of the spirit or the oil of turpentine used."

"*Substitute for Drying Oils.*—It has been recently discovered, that when a solution of yellow soap is added to red, yellow, and black paints, when ground in oil, before they are casked up, they acquire no improper hardness, and dry remarkably fast when laid on with the brush, without having recourse to any of the usual drying expedients."

"*Glue and Isinglass.*—Good glue should swell, when kept in cold water for three or four days: it should be semi-transparent, of a brown colour, and free from cloudiness. Before using it, it should be broken into small pieces, covered with cold water for some hours to soften it, then boiled till dissolved, and again allowed to congeal by cooling. The books in general recommend, as a size for gilding and bronzing, a solution of isinglass; but one of good clear common glue is much cheaper, and answers equally well. Isinglass, though a purer gelatine than glue, is not so easily dissolved."

"*Gum Arabic.*—What is often sold at the shops as gum arabic—the best of all the gums—is frequently only the clearer pieces of the gum Senegal, which, though equally strong and substantial, is far from being so pure as gum arabic. The imposition may be detected by observing one very obvious distinction. The genuine gum arabic is always in *small* irregular masses, *smooth on the outside;* the pieces of the gum Senegal are invariably larger, and *rough* on the outside."

The work would be greatly improved by the addition of an Index, or Table of Contents. Although very methodically planned, the subjects treated of are too numerous, and of too great variety, to be easily referred to without some help of this kind. It is the essential feature of a *Manual*, that it should be as handy as possible.

MISCELLANEOUS NOTICES.

Mode of Planting Reversed.—Agricola mentions what appears to be a very absurd method of planting, but which he found to succeed very well in most or all sorts of fruit-trees, timber-trees, &c. It consists in inverting, entirely, the natural position of the plant or shoot; the branches being set into the earth, and the root elevated in the air. Bradley also affirms, that he has seen a lime-tree, in Holland, growing with its first roots in the air, which had shot out branches in great plenty, at the same time that its first branches produced roots and fed the tree. A Mr. Fairchild, of Hoxton, has practised the same plan with success, and gives the following directions for performing it:—Make choice of a young tree of one shoot, of alder, elm, willow, or any other tree that easily takes root by laying; bend the shoot gently into the earth, and so let it remain until it has taken root. Then dig about the first root, and raise it gently out of the ground till the stem be nearly upright, and stake it up; then prune the roots, now erected in the air, from the bruises and wounds they received in being dug up; and anoint the pruned parts with a composition of two ounces of turpentine, four ounces of tallow, and four ounces of bees' wax, melted together and applied pretty warm; afterwards, prune off all the buds or shoots that are upon the stem, and dress the wound with the same composition, to prevent any collateral shootings that might spoil the beauty of the stem.—*Miss A. B.*

Hint to Barilla Sellers.—It is a common opinion that barilla that is broken into small fragments, and is reduced to powder, has lost its strength, and on this account there is generally an allowance made in the sale of the article, of from ten to fifty per cent. for this part of the barilla. It has been shown, however, by Dr. Revere, of New York, in a very able paper on the Crude Sodas of Commerce, in the last Number of the American Journal of "Science and Arts," that this notion is true only *to a very limited extent.* A considerable part of the soda is at first in a very caustic state; that part of the mass, therefore, that is exposed to the air, imbibes carbonic acid gas and moisture; but unless the barilla has been wet, and has thus lost a portion of its alkali, it is diminished in value only by the additional weight of the carbonic acid gas and humidity which it may have thus acquired.

Mineral Waters.—It is particularly remarked by Dr. Cullen, that preparations of iron, taken in small doses, often and regularly repeated, produce better effects than large ones, taken at long intervals; and to this it is doubtless chiefly owing, that natural mineral waters, drank on the spot where they arise, produce cures which we look for in vain from the strongest combinations of iron furnished by the shops. Few things have a more salutary influence on a debilitated frame than iron; it stimulates the fibres of the stomach and abdominal viscera, augments the tone of all the muscular fibres, invigorates the nerves, increases the strength of the pulse, gives colour to the cheek, and imparts to the whole system unwonted energy.—*Medicus.*

Epsom Salts.—The United States of America, which used to be furnished with Epsom salts from this country, have now the whole of their supply from a manufactory of their own, established at Baltimore, by Messrs. M'Kim, Sims, and Co. These gentlemen have succeeded in making a purer salt than that of Europe, at a much less price; and now manufacture about 1,600,000 lbs. annually.

London Clay.—The marly clay, known by the name of London clay, from the vast bed of it under the British metropolis and its neighbourhood, is one of the most universal of all visible strata. It is the common strata of all North America. Lieut. A. B. Eaton, of the United States army, traced it from the mouth of the Ohio to New Orleans, mostly covered (as usual) with Bagshot sand. It always effervesces when dry, and always contains muriate of lime; consequently all wells dug in it yield hard waters.—*Professor Eaton.—Silliman's Journal.*

Mammoth.—In excavating a canal near Schooley's Mountain, New Jersey, the skeleton of a mammoth was lately found, about three feet beneath the surface, in a remarkable state of preservation. It is stated in the American Journals to be so enormously large, that one of the teeth (the enamel of which was sound and perfect) measured, on the grinding surface, three and a half inches wide and seven long, and weighed four pounds.

American Porcelain.—A manufactory of porcelain has been established in Philadelphia, of the productions of which Professor Silliman speaks in the following flattering terms:—"The porcelain of Philadelphia is very beautiful in all the principal particulars,—in symmetry of modelling—in purity of whiteness—in the characteristic translucence—in smoothness and lustre—and in the delicacy and richness of the gilding and enamel painting. That it rivals the finest productions of Sevres itself, it is not necessary to assert; but it certainly gives every assurance, that if properly supported, it will not fail to meet every demand of utility and taste, which this great and growing country may present." The raw material is very abundant at a little distance from Philadelphia, and is found in many other parts of the United States.

Supply of Water in Rome.—Although the city of Rome is abundantly supplied with water by its different aqueducts, yet the want of cleanliness is remarkable in every street or corner. The water is not conveyed by pipes into the upper floors of buildings, but into a common fountain in the courts of each. In order to raise it to these stories a strong iron wire is fixed, with one end above the fountain, and another above the window; a bucket is made to slide along this wire, having a rope attached to it, by which it is let down into the fountain, and passed over a pulley above the window: the end of the rope is held by the person in the window; and when the bucket is filled, he draws the rope, and it slides along the wire as a guide until it arrives at the window, where it is disengaged by the attendant.—*A Traveller.*

Water Pedestrian.—An Hungarian of the name of Mahersy has discovered the means of walking on rivers, however rapid be their currents. He uses a pair of long boots made of very thin iron plate, surrounded at the upper extremity with a quantity of cork. He made a public trial on the 26th March, at Pest, in the waters of the Danube, and was successful.—*Athenæum.*

NEW PATENTS.

Francis Westley, of Leicester, cutler, for an improved apparatus for whetting or sharpening the edges of the blades of knives, or other cutting instruments.—6 May—2 months.

Rear-Admiral Samuel Brooking, of Plymouth, for a certain turning or shipping fid, for securing and releasing the upper masts of ships and vessels.—6 May—6 months.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-Row, London.

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Mechanics' Magazine,

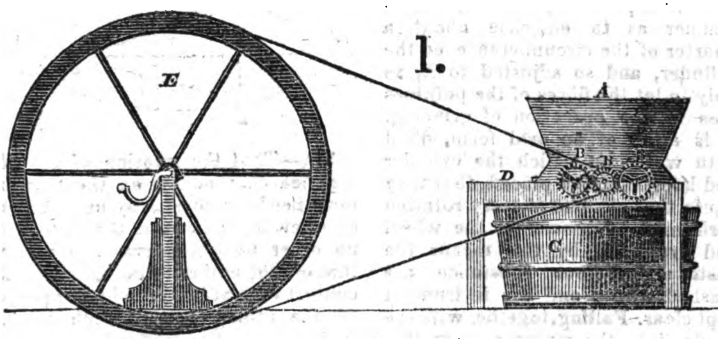
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 255.] SATURDAY, JUNE 28, 1828. [Price 3*d*.

"As we have opportunity, we are to do good to all men, and send abroad our beneficent regards to the great family of man."—J. A. JAMES.

POTATO GRINDING MACHINE USED IN FRANCE AND SPAIN.

1.



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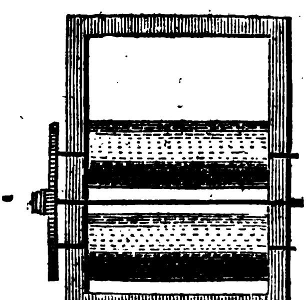

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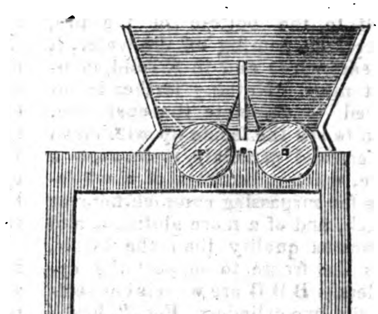

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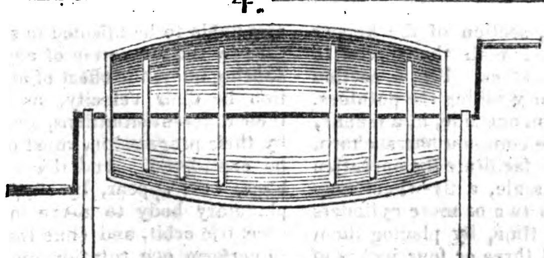


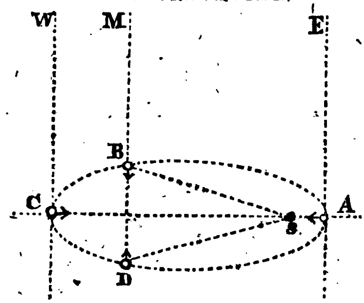
POTATO GRINDING MACHINE USED IN FRANCE AND SPAIN.

[*From a communication of G. G. Barrell, Esq., Consul of the United States at Malaga; to H. A. S. Dearborn, Esq., Boston, and inserted in the Franklin Journal.*]

The principal part of the apparatus is a wooden cylinder, of about three feet in circumference, and four in length, covered with tin, perforated like a grater. A, Fig. 1, is a section of a wooden box, or hopper, capable of containing five or six bushels of potatoes, placed in such a manner as to embrace about a quarter of the circumference of the cylinder, and so adjusted to it, as only to let the fibres of the potatoes pass in the operation of grinding. C is a tub of an oval form, filled with water, on which the cylinder and hopper are so placed, that they dip in that element at every rotation performed by means of the wheel and crank E; by this means the paste and fibrous substance are washed away, and the instrument kept clear. Falling, together with the fecula, into the water, a separation immediately takes place; the latter, by its specific gravity, precipitating itself to the bottom of the tub, where, on pouring off the water, it appears white and in a solid compact mass. Nothing further is required to complete the operation, than to stir the fecula up with clean water, and percolate it through a seive, when it becomes of a whiteness far surpassing common flour or starch, and of a more glutinous and tenacious quality than the latter. D is the frame to support the cylinders. B B B are wheels connecting the two cylinders. Fig. 2, birds-eye view of cylinders, frame, and tub. Fig. 3, section of the hopper and cylinders, with the pieces to guide the potatoes. Fig. 4, section of the cask for washing the potatoes, with a door on one side, in a manner similar to the common barrel churn.

In order to facilitate the operation on a grand scale, a fly-wheel may be applied to two or more cylinders at the same time, by placing them within about three or four inches of one another; by which means immense quantities of potatoes may be ground in a day, without a greater impulse than that of a single man, or even a turnspit dog.

ON THE PERFECT UNIFORMITY OF SIDEREAL TIME.



Sir,—That the rotation of any of the heavenly bodies on their axes must needs be constantly uniform, is quite evident; because the action of no other body whatever can affect that motion without coming in actual contact with at least the higher parts of the atmosphere of such body. Neither can the uniformity of the rotation be affected by any progressive motion which such body may happen to have, as that of a planet in its orbit. Wherefore the rotative motion necessarily being always the same, it remains to examine what effect the progressive motion of any planetary body in its orbit may have with respect to objects at an infinite distance; as the fixed stars, which have no parallax, must be supposed to be in any computation.

The motions of the heavenly bodies in their orbits being quicker or slower, as they approach towards or recede from the respective centres round which they revolve, and being also liable to be affected in some degree by the attraction of any neighbouring body, the effect of any variation in their velocity, as well as their different situations, occasioned by their progression, must of course be considered. And this will, perhaps, best appear, by supposing a planetary body to move in a very eccentric orbit, and (like the moon) to perform one rotation on its axis

in the same time it performs one revolution in its orbit.

Let A, B, C, D, represent the orbit of a planet, and S the focus occupied by the sun. It is obvious that the planet will move from A to C in the same time it moves from C to A; and, consequently, that it will have turned half round on its axis on its arrival at C, and wholly round on its arriving again at A; whence it will, in both situations, have precisely the same side towards the sun, as represented by the dart pointing thereto.

But its velocity being much greater in the lower part of its orbit than in the higher, will cause it to move from D through A to B, in the same time it moves from B through C to D. Wherefore, as its rotative motion is perfectly equable, and it performs half a rotation in the time it moves from A to C, it will have performed only one quarter of a rotation in the time it moves from A to B; and in moving from B through C to D, it will have performed half a rotation—the dart, in these situations, pointing many degrees from the sun, and the solar time varying accordingly

But to determine the effect on the fixed stars;—let an observer be placed on the planet exactly opposite the dart, and which will be precisely midnight at A and C; and suppose a star observed in the eastern horizon when the planet is at A, as E; then, as lines proceeding from different points of observation to an object at an infinite distance must needs be parallel, it is clear that when the planet arrives at B, as it will have spent one quarter of the period of its orbicular revolution, so also it will have performed 90 degrees of its rotative motion, and consequently the same star will now appear in the meridian, as at M; and when the planet arrives at C, that star will appear in the western horizon, as at W. Whence it is plain that the rotative motion only affects objects at what, in this case, must be esteemed an infinite distance; and that the progressive motion, however it may vary solar time, has no effect whatever on sidereal time, which is therefore of necessity constantly equable.

J. H.

Barton-upon-Humber.

DESCRIPTION OF A DESIGN FOR A SUSPENSION BRIDGE OVER THE MERSEY, AT RUNCORN.

BY THO. TELFORD, ESQ., CIVIL ENGINEER.

Sir,—As suspension bridges have made so much noise in the mechanical world, I will, with your permission, lay before your readers some account of a proposed suspension bridge over the river Mersey, at Runcorn, for the purpose of connecting the counties of Chester and Lancaster together, designed by Mr. Thos. Telford.

The centre opening (or space between the two suspending piers) is 1000 feet, and the two side openings (or space between the suspending piers and the front of the retaining walls) are 500 feet, which makes the length of the roadway of the bridge 2000 feet.

The distance between the roadway and the high-water mark is 70 feet. There are two carriage ways, of 10 feet each in width, and a foot-path of 5 feet, in the centre of the roadway.

Mr. Telford proposed that there should be 16 suspending cables; that is, 4 on each suspending line. Each of the main suspending cables are composed of a number of flexible iron rods, half an inch square; upon each side there is placed an iron segment, which nearly, though not wholly, covers each side; these segments complete the circular cable, cover the joints, and afford the means of compressing them firmly. The section of each cable will be about 12½ inches. In constructing the cables, there is little reason to doubt but that the half-inch rods might all be formed with great correctness, so as to fit each other with the desired accuracy; but Mr. Telford intended to introduce a mixture of bees' wax and rosin to pervade every interstice and unite the whole in one mass, so that it would be impervious to water.

The surface of the cables are then to be covered with flannel, previously saturated in the before-mentioned composition; and then the whole is firmly wrapped round with wire, which embeds its lower half in the moistened flannel, and leaves the outer surface only to be protected from the action of the atmosphere.*

This wire, wrapping effectually, binds all the parts of the cable into one firm mass, which is further secured, at the distance of every 5 feet, by the bucklings which connect the suspending rods with the main cable.

Thus connected and bound together, the parts might be considered safe from the great extent of surface exposed to friction. But Mr. Telford did not mean to rely on that alone, but proposed welding each half-inch bar, and also the covering segments, so that each shall constitute one filament the whole length of the bridge.

Each cable may be removed and replaced singly, without materially affecting the bridge. The extremity of each of the cables is extended along the abutment walls for about 100 feet, and in that distance secured in cast iron frames firmly connected, by wrought iron ties, with such a mass of masonry as will be more than sufficient to resist the strain to which these cables are exposed.

The weight, it is evident, consists of the timber and iron work, of which the roadway is composed, with the iron rods by which it is suspended to the cables; also the side protecting railings.

These parts consist of 4 longitudinal horizontal iron bars, 4 inches by 1 inch, with cross horizontal connecting bars 1 inch square. These bars are intended more as a frame to support the wooden beams until adjusted in their places, than as affording much strength. Upon these bars, at the distance of every 5 feet, are placed 2 transverse beams, each 9 inches by 6, between which the suspending rods are passed, and under which they are secured by plates and wedges. Upon these transverse beams are laid 23 longitudinal beams, each 6 inches square; that is, 2 along each outer edge of the roadway, and 2 along each side of the footway. Between each of these parts the suspending rods are likewise passed. Along each carriage way, 3 beams, each 6 inches square, are laid under the track of each wheel; one of the same size under where the horses will travel; and one in the middle of the footway. Across the longitudinal beams are laid 2 rows of 3-inch planking, so as the upper shall cover the lower joints, and the whole secured to the beams by screw-bolts, passing down the middle of each carriage way, and also the footway; thus communicating the pressure which may be placed on any given point over the whole breadth, and to a considerable distance along the roadway. These timbers are also disposed so as to admit of being taken out and replaced.

(To be continued.)

ON THE CONSTRUCTION AND USE OF THE SACCHAROMETER, AND FERMENTING MALT LIQUORS.

BY MR. THOMAS SADDINGTON,

Author of "Plain Directions for Family Brewing."

(Concluded from p. 364.)

The density or weight of wort should be taken before the yeast is added to it; for as soon as fermentation takes place, a reduction of density commences, and continues to go on, not only while the wort is in a state of fermentation, but also after it is tunned into the cask, and even after it is bunged up; and still goes forward, as long as any unattenuated fermentable or saccharine matter remains to be acted on, or until the acetous fermentation takes place, and the liquor turns sour. Here let it be observed, that when fermentation has commenced, there is no method of ascertaining the original density.

It is not my intention to enter into the principles of brewing more than is sufficiently necessary to explain and illustrate the utility of the saccharometer. If the density of the wort is taken soon after it is drawn off from the mash-tub, it will be

considerably lighter than when it is cooled down to a proper heat for pitching or setting to ferment. If the wort is about 130 degrees of heat, you must add about 5 pounds to the density, to make it equal to the density when it is cooled down to 60 degrees; and if it is 120 degrees of heat, you must add 4 pounds to the density, as will be perceived by the following short Table.

Table for showing the Density or Weight of Wort necessary to be added to the Density at different degrees of heat, to make it equal to the Density when cooled down to 60 degrees of heat.

Degrees of heat.	Pounds to be added.
130	5
125	4½
120	4
115	3½
110	3
105	2½
100	2
95	1¾
90	1½
85	1
80	0¾
75	0½
70	0¼
65	0
60	0

By this Table it will appear that if the density of wort is 18 pounds at 130 degrees of heat, you must add 5 pounds to it, as it will be 23 pounds density when cooled down to 60 degrees of heat. Again, if it is 24 pounds density at 110 degrees of heat, you must add 3 pounds to it, which will make it equal to 27 pounds for the proper density, when cooled down to 60 degrees of heat, &c. &c.

When the saccharometer is used, a deep piggin or tin jar will be very convenient to put the wort in, so as to prevent the instrument from being sunk by overloading it with weights, when placed in the wort in the tub. Having filled your piggin or jar with the wort, place the saccharometer in it, and load it with the weights until it sinks to the gauge point; then look into the Table for the number of drachms in the cup of the instrument, and against them you will have the weight or density of the wort you are trying the strength of; and supposing such wort to require 16 drachms, or 1 ounce, to sink the instrument to the gauge point on the stem, the weight or density will be 33 pounds 14 ounces by the Table; but the ounces may be rejected in a family brewery, where particular accuracy is not required. Again; supposing the instrument supports 12 drachms, or 3 quarters of an ounce, at the gauge-point, such weight will indicate 25 pounds density. Also, if the instrument requires 7 drachms, it will indicate 14 pounds of saccharine matter contained in the wort, which may be considered as good family beer; and the 25 pounds for ale, of sufficient strength for general use; and the 33 pounds as very strong keeping ale. In my Treatise on Family Brewing, before referred to, I have given a Table of Density for different qualities of malt liquor; viz.—"Small beer, from 6 to 9 pounds per barrel, of 36 gallons, heavier than water; table beer, from 12 to 15 pounds; harvest ale, from 18 to 24 pounds; Christmas ale, from 27 to 30 pounds; and above 30 pounds, very strong ale."

The subject of fermentation, or, as it may be termed, the principles of attenuation in private families, is, comparatively, but little understood; and, indeed, it cannot be duly appreciated or understood, unless by a due application of the saccharometer. I have already remarked that soon after the yeast is added to the wort, attenuation, or a decrease of density, takes place, and it becomes of important necessity frequently to apply the saccharometer to ascertain the progress of such decreased density; for if it is not carried on to a sufficient extent, the liquor will remain muddy, and always on the fret, or, what is much worse, it will either enter into the acetous or putrefactive fermentation, and become either stinking or sour. Probably some of your readers may recollect that such misfortunes have befel them; and perhaps, unable to

give a good reason for the mischief, they may consider that the old witch had got into the mash-tub. On the other hand, if the attenuation is carried too far, either by being set to ferment too hot, or too much yeast added to it, the liquor will be driven forward with too much rapidity, rendering it greatly impoverished in flavour, by depriving it of the saccharine matter necessary to impart that peculiar rich fulness of flavour on the palate, so much esteemed in good home-brewed ale. It is one of the important advantages of the saccharometer, to point out the progressive decrease of density in fermentation; and as soon as it has decreased to the required pitch, it must then be immediately tunned, or, as it is termed, cleansed. If the fermentation is not carried on sufficiently, the liquor will be thick, and of an unpleasant sweet flavour; and if it is carried too far, it will be thin flavoured, yet, at the same time, it will be increased in brightness and strength of spirit: therefore a strict attention is necessary in the process of fermentation, and, for that purpose, the saccharometer should be used two or three times every day while the wort is working in the tubs.

It is generally considered that public brewers attenuate their ale much lower than private families, in order to give it brightness and a due portion of spirit; and that by this means they are enabled to bring it into use much sooner than a slight attenuated and rich full-flavoured ale.

The following Scale may afford some information, as a medium rule for directing the process of fermentation.

Pitching Density.	Cleansing Density.	
lbs.	lbs.	lbs.
30	20 or	18
27	18 —	16
24	16 —	15
18	14 —	12
15	12 —	10
12	9 —	8

From this Scale you will perceive that strong ale wort may be attenuated 10 or 12 pounds below the pitching density, and that table beer should not be attenuated more than 3 or 4 pounds below the pitching density. In summer time the worts should be brought down lower than in winter, and particularly those which are intended to be soon used.

I have already observed, that the subject of fermentation, or, as it may be termed, the principle of attenuation, in private families, is, comparatively, but little understood; and I have been thus explicit, and enlarged this essay probably beyond the limits allowed by your Magazine, in order to draw forth the attention, and to call into action the sentiments of your correspondents, to a subject of so much importance in a well-conducted family brewery. And when I am inviting and calling forth the sentiments of your correspondents to a discussion on the principles of fermentation, and while a diversity of opinions may be expressed, yet the object may be to promote general good. I hope they will bear in mind this valuable motto—MATTER OF OPINION IS NOT ALWAYS MATTER OF FACT,—as it may tend to suppress that bitter sarcastical mode of writing their own opinions, which too frequently occurs in controversial subjects.

It is my general practice to keep a regular journal account of the density of worts in every brewing, and also the quantity of yeast used in proportion to the density of the liquor; and after it has commenced fermentation, with a good head of yeast, to skim it clean off; then to apply the saccharometer, to ascertain the decrease of density; then to stir up the worts well with the hand-bowl, keeping it close covered over, and repeating this process two or three times every day, until it acquires the desired cleansing density.

Thus far I have communicated the outlines of my own opinions on the principles of fermentation, and shall feel a pleasure in learning the sentiments and diversified opinions of your corresponding subscribers; and shall also feel an equal pleasure in affording other information, or endeavouring to explain and clear up

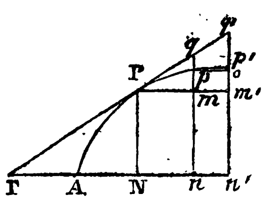
any apparent difficulty or ambiguity in this paper, to the satisfaction of your readers; and should any of them be desirous of having the small Treatise I have before mentioned, on Family Brewing, or the saccharometer, they may be supplied with them, on application to me, No. 8, Upper John-street, Commercial-road.

THOMAS SADDINGTON.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(Continued from p. 342.)

The few examples we have given, may serve to show the method of finding the maxima and minima of quantities, concerning which many problems arise in philosophical questions. We will now proceed to draw tangents to curves; which will, by and by, lead us to speak of the different orders of fluxions.



Let A P be a curve, to which it is required to draw a tangent at any point P.

Suppose the line T P q_1 to be this tangent.

Let $n\ m\ p\ q$, $n^1\ m^1\ p_1\ q_1$, be drawn near to each other, and to the ordinate N P, and perpendicular to A N. Draw also $p\ o$ parallel to A N.

Then, by Euclid, b. vi., that
N T : N P :: P m_1 : $m_1\ q_1$;
also, P m : $m\ q$ :: N T : N P,
it is evident that the ratio $m\ p$: m P is more nearly equal to the ratio $m\ q$: m P than the ratio $m_1\ p_1$: m_1 P is to $m_1\ q_1$: m_1 P.

Hence, $m\ p$: m P is more nearly equal N P : N T, than is $m_1\ p_1$: m_1 P. And the more nearly we make $n\ q$ come to N P, the more nearly does the ratio $m\ p$: m P approach N P : N T.

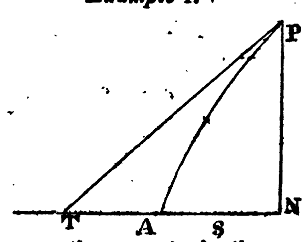
Hence, the ratio N P : N T is the limit of $m\ p$: m P. But since m P, m P are increments of the ordinates N P A N, by p. 278, the limit of $m\ p$: m P is the ratio of the fluxion of N P : the fluxion of A N, or the ratio $\dot{y} : \dot{x}$.

Therefore, the ratios $\dot{y} : \dot{x}$ and N P : N T being both limiting ratios to $m\ p : m$ P, they must be equal.

We have, then, N P : N T :: y. : $\dot{x}$., and N T $= \dfrac{\text{N P}.\ \dot{x}}{\dot{y}} = y\dfrac{\dot{x}}{\dot{y}}$; and, from the nature of the curve in question, having found $y\dfrac{\dot{x}}{\dot{y}}$, we have only to take N T equal to it; and having drawn N P perpendicular to A N, to join P and T, and P T will be a tangent at P.

Here N T, being measured from right to left, is negative with respect to x, and we must therefore use the expression $-\dfrac{y\,\dot{x}}{\dot{y}}$.

Example 1.



Suppose the curve to be the common parabola, whose equation is $y^2 = 4\ a\ x$.

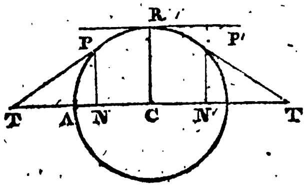
Then $2\ y.\ \dot{y} = 4\ a\ \dot{x}$;

$\therefore \dfrac{\dot{x}}{\dot{y}} = \dfrac{2\ y}{4\ a} = \dfrac{y}{2\ a}$;

$\therefore -\dfrac{y.\dot{x}}{\dot{y}} = -\dfrac{y^2}{2\ a} = -\dfrac{4\ a\ x}{2\ a} = -2\ x$.

Hence, to draw a tangent to the common parabola, at any point P, draw P N perpendicular to A N, and with A for a centre, and a radius A N, describe a circle cutting N A produced in T; join N P, and it is the tangent required.

Example 2.



To draw a tangent to the circle A P R, whose equation is $y^2=2rx-x^2$.

We have $y = \frac{r-x}{\sqrt{2rx-x^2}} x^\cdot$;

$\therefore \frac{x^\cdot}{y^\cdot} = \frac{2rx-x^2}{r-x}$.

And N T, or $-\frac{y.x^\cdot}{y^\cdot} = -\frac{2rx-x^2}{2-x}$.

Suppose $x=\frac{r}{2}$.

Then $-y.\frac{x^\cdot}{y^\cdot} = \frac{2r.\frac{r}{2}-\frac{r^2}{4}}{\frac{r}{2}} = -\frac{3r}{2}$.

If $x=r$, N T$=\frac{r^2}{0}$, and is infinite; and as it can therefore never meet A N, it must be parallel to it.

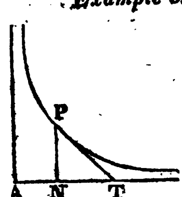
If $x=r+\frac{r}{2}=\frac{3r}{2}$,

then $-y.\frac{x^\cdot}{y^\cdot} = \frac{\frac{6r^2}{2}-\frac{9r^2}{4}}{-\frac{r}{2}} = +\frac{3r}{2}$;

which shows that the tangent is the same as when $x=\frac{r}{2}$; but that it is inclined in the opposite direction.

For the line $N_1 T_1$, which is called the subtangent, being positive, is measured from N_1, in the direction of x.

Example 3.



To draw a tangent to the curve whose equation is $xy=1$, or $x=\frac{1}{y}$,

$x^\cdot = \frac{1}{-y^2} y^\cdot$.

Now, since as x increases, y must diminish, $y^\cdot$ must be negative.

Hence, $\frac{1}{-y^2}.y^\cdot$ is positive, and

$x^\cdot = \frac{y^\cdot}{y^2} \therefore \frac{yx^\cdot}{y^\cdot} = \frac{1}{y} = x$.

Taking, then, N T in the direction A N, $a =$ A N; and joining P T, we have the tangent required.

We have here applied the doctrine of fluxions to geometrical purposes alone; it being our object, not to compile a regular treatise on them, but, by a dilated and clear explanation of their principles, to pave the way for a deeper inquiry into this most useful and interesting subject. By their application to natural philosophy, a most extensive field of knowledge has been opened to our view. Without their assistance we can scarcely derive any numerical results from Sir Isaac Newton's Principles of Natural Philosophy. Indeed, from the peculiar nature of the demonstrations contained in that stupendous and astonishing work, it is more than probable that the investigation of all the propositions was first effected by means of the fluxional calculus, and that they were afterwards translated into their present geometrical forms, to suit the comprehension of the mathematicians of the time.

In the limited subject of mensuration, when we consider the elegance and facility by which we may arrive at results which it far surpasses the unassisted powers of geometry to attain, we must be at once convinced of the superiority of this method over the laborious and imperfect expedients of the ancients. But when the splendid discoveries in physics are put into the scale, all comparison must cease: we might as well compare the glimmering of a candle to the splendour of the sun.

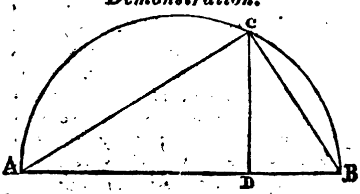
But notwithstanding the excellence of this system, which seems to leave nothing to be desired, another method, which we before mentioned, was discovered about the same time

by the celebrated Leibnitz; for which a superiority is claimed by most of the continental mathematicians, and which is gradually coming into fashion in this country. This is called the Differential Calculus; and in one respect it certainly deserves the superiority which is claimed for it over the method which we have just been considering: this is in its notation, by which symbols may be found for many formulæ, which completely transcend the limits of fluxional expression. Of this, as we have merely passed the threshold in our inquiries, and have not penetrated into the recesses of our subject, we can have no opportunity of judging, as the expressions alluded to belong to the highest and most abstruse parts of pure mathematics; but as the other difference exists in the very principles of the subject, it falls clearly within the object of this essay, and shall be treated of in our next.

(*To be continued.*)

THE EQUATION OF THE CURVE.

Demonstration.



Let $AB = d$ $DB = x$ $CD = y$; then will $AD = d - x$.

First, $\overline{AC}^2 + \overline{CB}^2 = \overline{AB}^2$

then $\overline{d-x}^2 = d^2 - 2dx + x^2 = \overline{AC}^2$,

and $y^2 + x^2 = \overline{CB}^2$;

then $d^2 - 2dx + x^2 + y^2 + x^2 + y^2 = d^2$

$$-2dx + 2x^2 + 2y^2 = 0$$

$$-dx + x^2 + y^2 = 0$$

$$y^2 + x^2 = dx$$

$$y^2 = \frac{dx - x^2}{x} = \frac{y^2}{x} = d - x;$$

then $\frac{y^2}{x} + x = d$ will be a general theorem for the diameter of the circle, and may be expressed in words; viz. divide the square of one-half the chord by the height of the chord; to that product add the height of the chord; and the sum will be the diameter of the circle.

N. B. The cord and the height of the chord of the segment are presumed to be given or known.

J. R.
Civil Engineer.

King's Square.

DESCRIPTION OF THE PROFILE MOUNTAIN IN NEW HAMPSHIRE.

BY GENERAL MARTIN FIELD.

(From the American Journal of Science and Arts.)

The Profile Mountain is nigh the road leading from Franconia to Plymouth, is five miles from the lower iron works in Franconia, and about three miles south of Mount La Fayette. The elevation of this mountain, I understand, has never been accurately ascertained; but it is generally estimated to be at least one thousand feet. The road passes very nigh the foot of the mountain, from which it rises abruptly, at an angle of about 80°, to the profile rock. The bare rock, on which the profile is delineated, is granite; and, having been long exposed to the atmosphere, its colour is a dark red.

dish brown. A side view of the projecting rock, near the peak of the mountain, in a northern direction, exhibits the profile of the human face, in which every line and feature are conspicuous. But after passing the mountain, to the south, the likeness is immediately lost.

The prefixed sketch was taken by a gentleman of Boston, and the likeness is a good one. The scenery is filled up from fancy. The whole of the mountain is covered with trees and shrubbery, except the profile rock.

REPORT ON A PROCESS FOR SEASONING TIMBER, INVENTED BY JOHN STEPHEN LANGTON, ESQ.

Mr. Langton having discovered a new method of seasoning timber, consisting in the removal of the greater part of the atmospheric pressure, and the application of artificial heat, by which the time necessary to season green timber, and render it fit for use, is only about twice as many weeks as the ordinary process requires years; he requests my opinion, first, on the influence this mode of seasoning may be expected to have on the wood; and secondly, on the practicability and advantages of the process on the large scale.

The ordinary mode of seasoning timber consists in evaporating the fluid matter (called sap) by the natural warmth of the atmosphere, with the precaution of screening the timber both from the direct action of the sun and wind, otherwise it cracks and receives much injury.

But seasoning by the natural warmth of the atmosphere, proceeds slowly and irregularly and much loss by decay takes place, unless the operation be conducted under the protection of a roof, to exclude rain and snow. Seasoning under cover is still a slow, though an expensive process; for at least three years should elapse from the time of felling the tree, to that of its being used in such framing as is wanted in naval architecture: hence a stock of timber, equivalent to four years' consumption, must be kept on hand; and three years' consumption must be either under cover, or suffering still greater loss by exposure to the wet.

In the new process the power of an air-pump is added, to draw the sap out of the interior of the wood; and the tendency of the fluid to the outside being thus increased, a higher temperature than that of the atmosphere can be applied, with less risk of causing the timber to split; consequently, the process may be completed in less time, and a few trials will show the best relation between the time and heat for the different kinds of wood.

Having briefly stated the process, I can with more clearness show the strong grounds on which my opinion is formed.

First, then, as to effect on the durability and strength of the wood. In the new process, as in the ordinary one, the sap is removed by evaporation; no solvent of the woody fibre is therefore introduced in either case, while the sap itself, being a fluid readily affected by temperature and other agents, it seems obvious, that the sooner it is wholly removed from the wood the better, provided the woody fibre contracts and solidifies without injury. That this may be done, is evident from the specimens from which the sap has been extracted; they exceed the usual density of specimens equally dry, and have lost about the same weight in drying that is lost in the usual method, with a somewhat greater degree of shrinkage. The sap which is extracted is a nearly clear liquid, having a sweetish taste, with a very peculiar flavour, and a musty and disagreeable smell. The latter seems to proceed from a light flocculent kind of matter floating in the sap, affording the strongest evidence, that the sooner such matter is removed from timber the better; and as it appears that the whole of this matter is removed by completing the process, I am of opinion the new mode of seasoning will render timber more durable than the common one, and it does not appear to be in any degree deteriorated in strength.

Secondly, the method is, undoubtedly, practicable on the large scale, and at an expense not exceeding ten shillings per load, with the advantage of setting free at least half the capital required by the common method; the advantage of rendering it unnecessary to spoil a good ship by the use of wood full of its natural sap; and the still greater advantage of rendering the living tree available, either for defence, convenience, or common use, in a few weeks after being felled, and in a state in which it may be trusted with safety; while, by the usual method, five years is not more than is necessary, to be equally free of risk from shrinkage and decay. The usual practice is to use timber partially seasoned; in consequence of which the sap has to evaporate, and the wood shrinks, the joints open, and the carpenter's skill in framing is rendered nugatory; for as timbers shrink, frames change their form, and lose their strength, and ships and houses alike afford evidence of the fact, particularly ships sent out to warm climates.

It only remains to add, that by the new method, the whole of the natural sap is extracted at once from the tree; it is known, by very simple means, when the whole has been extracted; the process requires only eight or ten weeks; it is more economical, and locks up less capital than the common method; and it contributes to the durability and soundness of timber framing.

THOMAS TREDGOLD.

16, *Grove-place, Lisson Grove,*
May 2, 1828.

ON THE CONSTRUCTION OF FIELD GATES.

Sir,—If you will favour me with a small space more in your valuable Numbers, I will endeavour to answer some objections which have been urged against the plan which I proposed relative to field-gates. In the first place, it should be rightly understood what is meant by the term "field gate;" and by loading them with superfluous timber in some of their parts, that they are frequently broken against the falling post. Secondly, what is meant by the idea, that "*if common gates* could be constructed with less timber, the saving of that article would be of national importance, on account of the millions to be supported." I will take any gate to pieces, in order to discover what part is superfluous, and where defective, as I put it together again. Mr. Jopling states, that the heel of his gate will take but about half the timber which the prop gate is calculated to take: granted; if the top and bottom bars are connected with it by an extra quantity of iron and screw-pins, which I have several objections to, for a common fence-gate; and these I will endeavour to point out in another letter, on the hanging of gates, &c., if this be admitted. If this gate is to have its whole support by thimbles only, which is the intention of mine, I cannot conceive it sufficiently strong. Let them both be ironed the same way, and I have yet to learn why mine will not do with the same substance as Mr. Waistell's. The back should have a substance of wood on each side of the tenons, at least equal to itself: I will put one bar in, and suppose it hung by thimbles between the two top and bottom bars; this bar and the others then become levers, and clumsy ones too, if as heavy at the head as at the fulcrum, or entrance into the back. The strength of the gate is entirely dependant on the tenons, when the bars are all placed in the back, if there be no prop or braces. I then put on the head, which unites the strength of the bars at the back, be it what it may, and they become one combined lever, both as to a lateral and downright pressure. What weight it could sustain at the head, I am unable to determine; and could wish to see pointed out at any given substance of the tenons, at 9 feet from the back, by some of your scientific readers. Some idea may be formed of its strength, by the illiterate, from the motion of the steelyard ball along the arm, compared with the shortest arm possible on the opposite side of the

fulcrum. I then support the place where the greatest stress lies, by the prop, at or near the middle of the top bar. I have seen many placed about three quarters of the way along it, and the other two uprights on the opposite side, dividing the length of the bar between the back and head into nearly three equal parts. I have seen many with only one upright, dividing the bar into two parts; which is nearly the case with the gate in question, in three bars out of five. It should be borne in mind, that the farther this prop extends, the more it becomes a lever, and the less a prop: here again I want information, how much stronger, or how much greater a weight the same piece of timber will carry in the middle, if supported horizontally or vertically, at the upper end; at an angle of 45°, I imagine it will be in the mid way between one and the other. This prop, which I consider equally as strong as the two braces proceeding from the heel of Mr. W.'s gate, they being nearly, if not entirely, dependant upon nails; whilst that has a foundation for the foot, and a shoulder for the top bar to rest upon, leaving the nail only to prevent it from straining outwards, by an extreme pressure downwards. I would not, however, recommend any per centage to be gained here in the tenons; the additional weight is very insignificant so far on the gate. There are two pressures on a gate, as stated before; and Mr. J. knows, by the rules for measuring the strength of timber, that a 2-inch square bar, which is 4 square inches of timber, at one inch in length, is only 8 in strength; whereas, a 4-inch square bar, containing 16 inches of timber, is 64 in strength, comparatively with the other; so that, if divided into such small portions as 1 inch square, it would take eight times the quantity to be of the same strength; if divided into 2 inches square, it will take only double that quantity. Thus, it appears, gate bars will be stronger with the same quantity of timber, the nearer they are brought to a square against a lateral pressure; but it reduces the strength, as shown before, against a downright pressure. A bar, 1 inch by 4, is 16 this way, and 4 the horizontal; when reduced to the square, it is 8 each way; but this should be taken into account,—they will be more liable to be split with nails, and the fence will not be so good, as the spaces must be wider apart, with the same number of bars. At the brace before-mentioned, I am convinced the gate is very considerably stonger than at the same place in Mr. J.'s, which may be easily perceived by inspection; having the strength of all the tenons, the prop and its nails, with this last brace, connected together for support. Whilst the prop is firm, it cannot fail at the tenons; and whilst the brace is firm, it has the strength of the whole substance of the bars combined with it: therefore, if one bar fails at this place, they must all fail together; and there needs no other supporters to a downright pressure. I have no doubt but it would carry a horse, should he happen accidentally to hang his hind parts upon it, by a failure in attempting to leap over, between this and the head; but on account of the bars being lightest at the head of the gates, for very obvious reasons, I would place an upright brace in the midway, to prevent their failure in that place, instead of crowding on a great deal more than double the quantity irregularly, and not having thus so good an effect; for where is the use of suspension or extension from the head, from what hangs upon nothing except the two first stays, which can have no support but from the braces, &c. at the heel, put what you will on? It does not follow, because Mr. Parker's construction had that error, and that so easily and effectually remedied, that it is not the strongest and most economical. That remedy has been applied to the eight gates, which are all in use at this time; and a fair specimen was given of a considerable number hung in the year 1799, without any failure, at present, on that account.

Art imitates nature in a variety

of ways. Were a scale beam made as heavy at the ends of its arms, as at the shoulder or fulcrum, it would appear very awkward; and if a human arm or leg should unhappily be so made, they would at once be called deformities. I have described the arms of the gate as somewhat corresponding to the root, the branches, and the trunk of the tree, from which I would have them cut. Nature has nearly shaped them for the purpose; and vainly shall we despise her, or look upon her productions as deformities. On taking the measure of both gates, nine feet long, leaving out one of the six bars, the oblique braces being equal in length to my prop, they turn out to be in my favour.

	ft.	in.	′	″	‴
Mr. Waistell's gate takes	2	7	0	3	4
Mine	2	6	8	0	6

The others are out of hedge-row timber, therefore the per centage is on the opposite side; there is no allowance for waste in either.

I know nothing of Charles Waistell, Esq. Mr. Parker, or any of their writings, neither have I any knowledge of Mr. Jopling, more than what I have derived from your numbers; having no wish to appear conspicuous, I will now beg leave to subscribe as before,

Yours, &c.

AN EX-LEICESTERSHIRE FARMER & GRAZIER.

P. S. If a common parallel ruler be made firm and immoveable at one end, the braces become motionless.

KNOWLEDGE OF THE ANCIENTS.

Sir,—On reading the exordium to Mr. Dubois' first paper (page 90), I flattered myself that I should have the pleasure of meeting a fair, unprejudiced statement; and as I internally applauded the justice of his introductory remarks, I also expected that he would follow what he preached. But I was disappointed in my hopes. I found that he was himself prejudiced; that the middle road was forsaken,—the ancients being the theme of his admiration, while the moderns hold but an inferior station in his estimation. I should but ill deserve to claim a place in your Magazine, were I to proceed on any plan which would tend to deceive. I do not know either Greek or Latin; my knowledge of the ancients is therefore drawn from the perusal of translations; and on that experience I found what I promise myself is an impartial judgment. I shall pass over that portion of your correspondent's letter which treats of the fame the ancients wrote for, as his arguments on that subject do appear to me to bear their own refutation along with them.

Mr. Dubois asserts that modern authors will not bear comparison with the ancients, when individually opposed. If I understand him rightly, he takes the term *modern* in its most extended acceptation; but even allowing it to be narrowed to the present day, I am not afraid to assert that we should not come off either wanting or beaten. We have an Anacreon superior to the Grecian; orators who may well dispute the prize of eloquence; generals fully equal; artists superior; and philosophers who need not hide their heads before those of the olden times.

If in *Epic Poetry* the ancients had Homer, it should ever be borne in mind that we have a Milton, whose honoured name may well stand before that of the inspired Pagan. I speak of Homer, too, as he appears in the translation of Pope, who is allowed by many eminent critics to have greatly improved the original. Cowper has also favoured us with a translation, in which he has done his utmost to adhere to the text of Homer, without adding to or diminishing. But who would hesitate a moment in choosing between the two versions? As to the assertion, therefore, that we are "not much inferior" to the ancients, I cannot help saying that we surpass them; and not the combined talents of the whole world, either in past or present times, present to us so brilliant a display as that of Great Britain

alone, leaving other nations out of the question.

My knowledge of the ancient *historians* is so circumscribed that I shall not pretend to sit in judgment on them; their eloquence, however, is but a small compensation for their egregious blunders and wilful errors. If Shakspeare be, as Mr. Dubois confesses, "matchless," how can he consistently contend that any one is superior to him? I think it would be no difficult task to show that, both in respect of beauty of language and unity of design (as far as is consistent with the interest which ought to be maintained in dramatic compositions), the modern tragedians are fully equal to their predecessors; and that, in all that regards the power of exciting emotions such as those of admiration, pity, or wonder, they have far surpassed them. Neither is the "matchless" Shakspeare "matchless" as a tragedian alone; he excelled equally in the comic vein, and has had, in this department, many able successors, who have nobly sustained the mastery of the moderns over all the realms of comedy. But here I would wish to pause a moment, to observe what must be plain, if not attended to before; namely, that as the sphere of human knowledge has been enlarged, a proportional increase has taken place in the number and variety of the pursuits of men of genius; and that individuals who now shine in many things, would, in former times, by concentrating their talents, and directing them to one point, have been far more celebrated. Who among the ancients, for example, can, in point of successful versatility, be compared to Sir Walter Scott? And who will question that, had he been a Greek or Roman, and devoted his great powers exclusively to either tragedy, comedy, or history, he would not, in all probability, have equalled either Sophocles, Aristophanes, or Thucydides? The same remark may apply to several others of our present authors, whose genius is wasted on a multiplicity of objects; whereas, if confined, it would produce something of a more decidedly immortal character, something far beyond the evanescent fame of the passing day.

In "*oratory*" we may demand honours equal to the thunder of Demosthenes, or the lightning of Cicero—if we take, as a test, the effect produced on an audience by the eloquence and argument of the speaker.

In *philosophy, in the arts and sciences*, and in all domestic comforts, we far excel: it would be strange, indeed, if we did not,—if, after having the benefits of the accumulated experience and knowledge of ages,—if, after the innumerable inventions and improvements by which mankind have been enriched,—if, after all these blessings, we were not superior to the times of old.

Should your correspondent be able to establish his argument, even on those particulars which he has named, yet he has but half performed his task; and not even that, for in every department of the sciences do we as far excel the ancients as the Romans once surpassed the rest of the world. Nay, the comparison will not hold; for that great people, when in the zenith of their pomp and refinement, did not so excel as do the Britons now: theirs was the glory of war alone; the delights of peace and the refinements of humanity were beneath their exalted consideration. It may be said that I speak prejudicedly. I will not shrink from the charge: when I speak of my country I do feel a prejudice in its favour which I cannot suppress, arising, as it does, from a conviction of her great superiority over all the nations and dynasties that do or ever did exist; and cold-blooded is the man, and little to be cared for his feelings, who can approach the subject with as much indifference as he would a calculation of figures. I would not wish to decry the knowledge of other days; my folly and ignorance would, in so doing, be palpable; but I contend that they are right, in every sense of the word, who claim a decided superiority for the men of the present over those of

former days. The philosophers of former days had an advantage which those who follow had not; there were *few of them*, and they thus became far more noted than men, their equals in every respect, can expect to be now. No king would at the present day visit a Diogenes, and wish to exchange conditions with the philosopher; but I believe we have as many Diogeneses in our day as in ancient times would have filled a city. We are but too apt, moreover, to look with reverence on the learning of the ancients, merely because it is old; had Plato lived now, he would have been jostled in the crowd. We are like antiquaries, who value things in proportion as they have the stamp of antiquity. A copper coin, mutilated, and possessing the rich green of age, is far more valuable than the gold of Ophir; and although you manufacture for them a cargo of coins, different in no respect from the old one, and so like, that one shall not be told from the other; yet shall the one which was found in the earth be far more valuable than the one which is presently manufactured; and why? is old.

I am, Sir,
Your obedient Servant,
T. M. B.

THE COMPASS.

Sir,—Permit me, through the medium of your highly esteemed Miscellany, to request information explanatory of the following circumstance:—

I accidentally passed a small pocket compass (in order to try if the needle traversed correctly) over a mariner's compass, such as is generally used on board merchant vessels. During the progress of passing, my attention was arrested by observing a tremulous motion affecting the former; and, on a repetition of the trial, I remarked it became more violently agitated the nearer it approached the latter, until it traversed half round, and became stationary, the needle pointing precisely in an *opposite* direction; that is, the needle of the pocket compass pointing *due South*, that of the mariner's remaining *due North*.

I have since remarked a somewhat similar effect, though not precisely the same, produced with two pocket compasses. The uppermost, if placed immediately over the under one, has had the needle pointing *due West*, the under one pointing *due East*.

Some one of your numerous scientific readers may, perhaps, do me the favour to explain this circumstance. It may possibly be undeserving the attention of your more learned correspondents; but there are many, like myself, quite ignorant of the cause producing this effect, to whom the information may be as interesting as acceptable.

VIATOR.

Weymouth.

MISCELLANEOUS NOTICES.

London University.—Three native merchants at Bombay have taken shares in the London University. In the letter which conveyed the order upon their correspondent in London, to pay the 300*l*.—the amount of the shares—they liberally observe,—"Independently of a desire to give support to so noble an institution for its intrinsic merits, we have great delight in the prospect of exercising the rights of presentation which our respective shares confer, on the sons of English gentlemen who have engaged our affection in the intercourse of life or business, but on retirement to their native land with a numerous offspring, do not command the funds to afford their sons a liberal education." The letter is signed, Framjee Cowasjee, *Parsee*; Seejeebhoy Jemsetjee, *Parsee*; Moohummud Ulee Rogay.

Another London University.—The example set by Mr. Brougham and his friends has led to a project for the establishment of another University in the metropolis, under the patronage of the King, the Ministers, and the Bench of Bishops—in the same way as the popularity of the Lancasterian system produced the national schools on the system of Dr. Bell. The Duke of Wellington presided at a meeting held on Saturday last, to take the same into consideration. The new Institution is to be called the "King's College," and is to include a system of religious instruction according to the faith of the Church of England. The necessary funds are to be raised, partly by subscriptions and partly by proprietary shares, on the same plan as has been adopted in the case of the London University. A very considerable sum has been already subscribed, but the building is not to be commenced till the subscriptions amount to 100,000*l*.

Polishing Powder for Speculums.—The powder I prefer above all others to give an exquisite lustre, is colcothar of vitriol, and not putty. Putty gives metals a white lustre, or, as workmen call it, a silver hue; but good colcothar of vitriol will polish with a very fine and high black lustre, so as to give the metal polished with it the complexion of polished steel. To know if the colcothar of vitriol is good, put some of it into your mouth, and if you find it dissolves away, it is good; but if you find it hard and crunch between your teeth, then it is bad, and not well ground.

Good colcothar of vitriol is of a deep red, or a deep purple colour, and is soft and oily when rubbed between the fingers; bad colcothar of vitriol is of a light red colour, and feels harsh and gritty.—*Rev. John Edwards—Transactions of the Royal Society.*

Arris and Edge are two terms often indiscriminately applied, but by no means identical. Arris (from the French arête) signifies, strictly, the edge in which two surfaces meet each other; while edge is more properly applied to those two surfaces of a rentangular parallelopipedal body, on which the length and thickness may be measured, as in boards, planks, shutters, &c.—*B. B.*

Spanish Wool.—About the year 1350, Peter, King of Castile, having been informed that there was a race of sheep in Barbary remarkable for the excellence of their fleeces, sent several persons into Morocco to buy a number of bucks. From this epoch commenced the reputation of the wool of Castile. In the sixteenth century, when Cardinal Ximenes was the Spanish Minister, complaints were made to him that the sheep of Castile had deteriorated. To remedy the evil, this minister determined to import a great number from Barbary; but as he could not obtain them by negociation, he kindled a war and invaded Morócco. The Spanish soldiers, agreeably to the orders given them, brought away as many sheep as they could, and the reputation of Spanish wool was soon completely restored. All the fine races of sheep now in Europe, are descended from the merinoes of Spain

Economy of Time.—The Chancellor D'Aguessau, finding that his wife always kept him waiting a quarter of an hour after the dinner bell had rung, resolved to devote the time to writing a work on Jurisprudence. He put this project in execution, and in the course of time produced a quarto work of four volumes.

Oxford Prizes.—Among the prizes adjudged this year at Oxford, was one to Mr. T. L. Claughton, of Trinity College, for a Latin Poem, *Machinæ vi vaporis impulsæ.* We are glad to see University Exercises taking so practical a turn, and should have been still more pleased had so English a subject as that of the steam engine been clothed in its native dress. It appears very ridiculous to employ a dead tongue to celebrate a thing so perfectly modern as this. Latin verse too! as if, beyond all things in the world, cranks and pistons, and cylinders, were fit to be sung in melodious numbers. The verse must, we think, be *cranky* at best.

Arabian Method of building Arches.—At Bussorah, the inhabitants of which have no timber but the wood of the date tree, which is not thicker than a cabbage stalk, they make arches without the help of any frame-work. The mason, with a nail and bit of string, describes a semicircle on the ground; lays his bricks, fastened together with a gypsum cement, on the lines thus traced; and, having thus formed his arch, except the crown brick, it is carefully raised, and, in two parts, placed upon the walls. They proceed thus till the whole arch is finished. This part is only half a brick thick; but it serves them to turn a stronger arch upon.

The Brain.—This organ is larger in man than in any other known animal. Its general weight is, according to Soemmering, from 2 lb. 5¼ oz. to 3 lb. 3¾ oz. I have weighed several at 4 lb. The brain of the late Lord Byron (without its membranes) weighed 6 lbs., and contained more medullary substance than ordinary.—*Dewhurst's Essay on the Formation of Man.*

Andrew Ferrara.—Formerly no man in Great Britain knew how to temper a sword in such a way that it would bend so that the point should touch the heel, and spring back again uninjured; except one Andrew Ferrara, who resided in the Highlands of Scotland. The demand which this man had for his swords was so great, that he employed workmen to forge them, and spent all his own time in tempering them; and found it necessary, even in the day time, to work in a dark cellar, that he might be the better able to observe the progress of the heat, and that the darkness of his workshop might favour him in the nicety of the operation.—*Parkes.*

Arabian Substitute for Glue.—Instead of common glue, the joiners of Tunis, Tripoli, &c. frequently use a preparation of cheese, which is first pounded with a little water in a mortar, till the wheyey matter is washed out. When this is done, they pound it again with a small quantity of fine lime; and apply it afterwards, as quick as possible, to such boards as are to be joined together, which, after the cement becomes dry, cannot afterwards be separated without the greatest difficulty.

NEW PATENTS.

Mathew Fullwood, jun. of Stratford, for a cement or composition which he intends to denominate German cement.—6 May—2 months to enrol specification.

John Benjamin Macneil, of Foleshill, Coventry, engineer, for certain improvements in applying materials for the making, constructing, or rendering more durable, roads and other ways.—6 May—6 months.

Thomas Jackson, of Red Lion-street, Holborn, watchmaker, for a new metal stud to be applied to boots, shoes, &c.—13 May—6 months.

John Ford, of Vauxhall, machine maker, for certain improvements in machinery for clearing, opening, scribbling, combing, slubbing, and spinning wool, and for carding, roving, or slivering, and spinning cotton, short stapled flax, hemp, and silk, either separately or combined; and for spinning or twisting long stapled flax, hemp, silk, mohair, or other fibrous substances, and either separately or combined.—13 May—6 months

Thomas Bonsar Crompton, of Tamworth, paper maker, and Enoch Taylor, of Marsden, millwright, for certain improvements in that part of the process of paper making which relates to the cutting.—13 May—2 months.

Charles Chubb, of St. Paul's Church-yard, London, patent lock manufacturer, for certain improvements in the construction of catches for fastening doors or gates.—17 May—6 months.

Thomas, William, and John Powell, of Bristol, glass merchants and stoneware manufacturers, for certain improvements in the process, machinery, or apparatus, for forming, making, or producing, moulds or vessels for refining sugar; and in the application of materials hitherto unused in making the said moulds.—17 May—2 months.

INTERIM NOTICES.

"F." is requested to send to our Publishers for a letter addressed to him.

Communications received from A Lover of Truth—Vectis—H. H. (whose hint shall be attended to)—G. A. Atkinson—H. (Alnwick)—J. P. H—Mr. Wyatt—Embryo-Mathematicus—Two Constant Readers—Mr. Russell—V. and W.—Inquisitor—J. H. P.—C. Cox.

Erratum.—In motto of No. 254, for *mind* read *mine.*

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 256.] SATURDAY, JULY 5, 1828. [Price 3*d.*

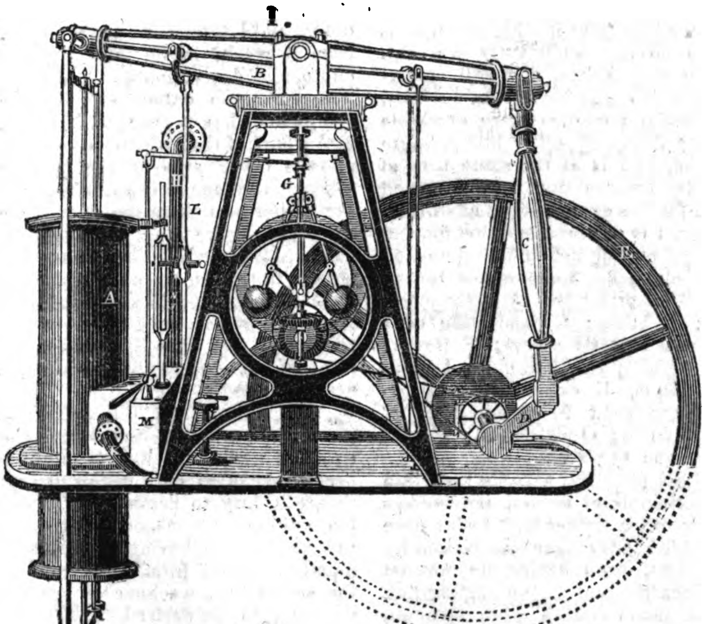
"It is clear that the plan which governs animals, who invent nothing, cannot be the same for beings who necessarily must invent, or it would be a planless plan. If each invented but for himself, unnecessary labour would be multiplied to infinity, and the inventive faculty be robbed of its highest value, that of continual increase."

J. G. Von Herder.

VAUGHAN'S STEAM ENGINE.

(*Communicated by Messrs. Vaughan and Co.*)

1.



The public not having as yet been made acquainted, in any publication, with the merits of Vaughan's Patent Steam and Atmospheric Engine, the patentees have to request the insertion in the "Mechanics' Magazine" of the following statement, which it is to be hoped will do away the ungrounded prejudice that has been spread abroad respecting it.

Numerous as the attempts at improving steam-engines have been, they have been hitherto chiefly confined to those of high pressure construction; and as the higher you raise steam the greater is the friction you have to counterbalance, attention has, with respect to them, been chiefly directed to increase the efficiency of the pistons. But no improvement has been made on low pressure engines, beyond what Bolton and Watt, or rather James Watt, realized; and too generally it has been thought that there was no room for any,—a notion which, coupled with the very great prejudice against all new machines, makes it somewhat difficult for an inventor to get improvements introduced and tried.

The great superiority which Messrs. Vaughan and Co. claim for their engine, may also have had its effect in encouraging incredulity; but they claim nothing for it which numerous trials do not sufficiently warrant. What they affirm, and will endeavour to prove by incontestable facts, is, that it possesses more available power than any other low pressure engine, and is at the same time of simpler construction, and attended with far less expense than any other.

Fig. 1 is an elevation, and fig. 2 a plan of an engine on Vaughan and Co.'s plan; fig. 3 one on the Bolton and Watt principle. A is the cylinder; B beam; C connecting rod; D crank; E fly wheel; F frame; G governor; H steam pipe; I injection plate; K exhausting pipe; L air-pump rod; M steam box; N steam valve; O piston rod; P solid partition; Q pistons.

When practical persons look into our principle of action, the sources of our extra power will be at once perceived. We have less friction by one-third, from having no parallel or eccentric motion, no stuffing-box for a piston rod to work through, and from having, of course, a less number of bearings. Instead, also, of the power of steam only being called into operation, we have both the power of steam and that of the atmosphere—the one of which costs us nothing.

Some persons, calling themselves engineers, assert, ignorantly, that there is no advantage obtained by us from the pressure of the atmosphere. It acts, they say, against as well as for us, both at top and bottom. They forget that every engine has the pressure of atmosphere to contend against until the water arrives at a boiling heat; and that other pistons, as well as ours, will not rise till the steam overcomes the pressure of the atmosphere. But mark the difference between this and the ordinary engines, when the pressure of the atmosphere is counterbalanced. When Bolton and Watt's piston is hard packed, so as to occasion as perfect a vacuum as ought to be procured, in order to be possessed of the power calculated on (or, as many say, estimated), that is to say, $4+14\frac{3}{4}=18\frac{3}{4}$, on the inch, it cannot stir; but when relieved a little, it moves though with difficulty, until blown through. Even then it works in an imperfect vacuum, and, consequently, defectively. The air-pump exhausts both the steam that has performed its duty, and a part of that which is working on the other side of the piston; whence any one may perceive, that the higher you raise the steam, the more the engine is apt to be what is called *throttled.* The condenser would, in fact, in the course of time, have a double portion of steam to condense, if the packing were not renewed; nor can this defect be remedied as long as the two actions are performed in one channel. Now, by Vaughan's patent, the harder the pistons are packed, the better the engine works, from obtaining a more perfect vacuum; each piston has its separate duty to perform, yet both act at once; the piston worked by the atmosphere having its communication cut off from the steam by the slide valve, we have all the advantages to be derived from a vacuum, and the other of steam; taking 14 lbs. as the measure of the one, and 10 lbs. as the measure of the other, we have 24 lbs on the square inch.

The following comparative calculation will place these facts in a still stronger point of view.

A Bolton and Watt Engine of 28 horse-power; the Cylinder 30 inches diameter; Area 706 inches.

This engine works steam of 4 lb. pressure on the inch, which is said to expand upon the piston with a vacuum underneath equal to 18 lb. pressure on the inch; and it is said, that from an imperfect vacuum and the friction of the engine, there is only a working power left of 8 lb. on the square inch. (See Stuart on Engines, p. 131.)

Area of Cylinder......	706 inches
Working power	8 lb. per inch
Lift of the Engine....	5648 lb.
Piston ought to travel	220 feet per min.
	112960
	11296
Speed and power of a horse	44,000)1242,560(28 h.p.
	88
	362
	352
	10

This engine cannot work steam to any advantage of a higher temperature than 227½ degrees of heat; as, if she does, her vacuum is not so good, and there will be found to be more than a balance of power lost, as the heat of the cylinder increases; and even at steam of the pressure of 4 lb. on the inch, the best vacuum these sort of engines do, and can make, is 9 lb. on the inch.*

A Steam and Atmospheric Engine of Vaughan and Co., of 49 horse-power; the Cylinder 30 inches diameter; Area 706 inches.

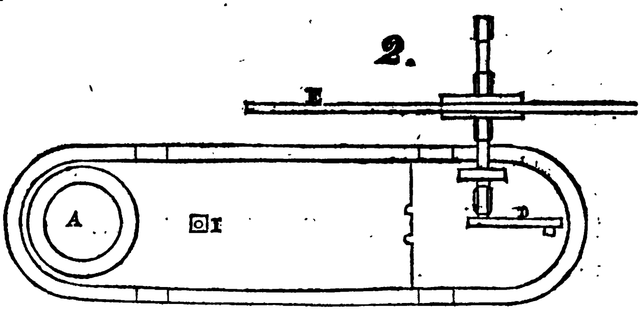
This engine works steam of 10 lb. pressure on the inch on one piston, and makes a vacuum under the other, which causes the pressure of atmosphere to operate on it equal to 14 lb. on the square inch, which makes on both pistons a pressure of 24 lb. on the inch; and, after allowing the same deduction as on Bolton and Watt's principle for an imperfect vacuum and friction (which it has not), the working power will be only 14 lb. on the square inch.

Area of cylinder	706 inches
Working power	14 lb. per inch
	2824
	706
Lift of the engine	9884 lb.
Piston ought to travel	220 feet per min.
	197680
	19768
Speed and power of a horse	44,000)2174,480(49 h.p.
	176
	414
	396
	18

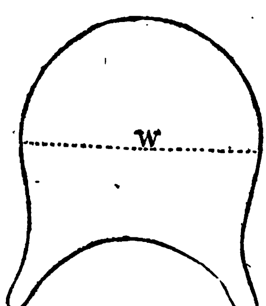
This engine works steam of the temperature of 289½ degrees of heat, and can continue to work steam to advantage, and condense it well, up to 250½ degrees, and make a vacuum equal to 12 lb. on the inch at the lowest temperature, and 10 lb. at the highest, as the cylinder is at all times in a cooler state than other engines, being open at both ends, and the condensation being made much quicker, from the superior action of this engine over others. The friction in this, too, will be found, on inspection, to be at least one-third less than other engines. It will, besides, only consume the same quantity of coals as the other engines of 28 horse-power. An engine of the above construction has been erected on the premises of the patentees, and may there be seen in constant work, realizing every one of the advantages above stated.

* We refer our readers to Mr. W. Margett, miller, of Hemmingford, near St. Ives, in Huntingdonshire, where we pulled down a 22-inch cylinder on B. and W.'s principle, and erected one of 17-inch of ours to perform the same work, which it did, and more, and is still doing, with the same packing on the pistons; it being eighteen months since the engine was put to work. *June* 1, 1828.

Some engineers have had the seeming candour to allow us to be *equal* to Bolton and Watt (vide Galloway's History on Steam-Engines, p. 190) for power; but we must be either better or worse, for equality is out of the question. It is clear that if, as has been alleged, we have the atmosphere working against us as well as for us, our engine should be worse than any other, as it would only have the power of steam to work with, which power would be absorbed in friction, leaving us at a complete stand still. We would ask these very able calculators of power, why they have not the pressure of atmosphere operating against them in walking the streets? Is it not on account of the breath or air within? Exhaust that, and how far would they go? Even so it is with our engine. Steam occupying a space under one piston, can have none of the pressure of the atmosphere, and acts with the power as on the safety



valve of the boiler, which allows the steam to escape on its coming to a pressure above its weight. The steam, again, under the other piston being exhausted and condensed, by means of the air-pump and condenser, leaves the most perfect vacuum yet attained in an engine for



the pressure of the atmosphere to operate; which pressure is calculated to be equal to 15 lb. on the inch, which is obtained at less expense and friction than by any other engine yet made.

We have to beg of those persons who either use or may require an engine, to inspect any one of those which we have lately erected, such as—

One of 50 horse power, at the premises of the patentees.

One of 20 horse power, at the Globe Works, Sheffield, York.

One of 8 horse power, at Messrs. Hillyards, corn-dealers, Lynn, Norfolk.

One of 4 horse power, at Messrs. Parsons, tobacconists, Sheffield, York.

And if they possess any knowledge of the working principles of an engine, and are not misled by interested engineers, we are sure they will at once allow that, in point of power, simplicity, and economy in all respects, they exceed anything which has been yet brought before the public.

Facts are stubborn things, and time will open the eyes of the public, notwithstanding the interested prejudices of some, who, not being able to account for the working of one power, are still more completely at a loss when asked to explain the principle of two powers. Could an instrument be devised to prove the working power of steam engines, at

the crank or fly wheel—that being the point from whence the work proceeds,—it would prove a great *benefit* to purchasers of power, and

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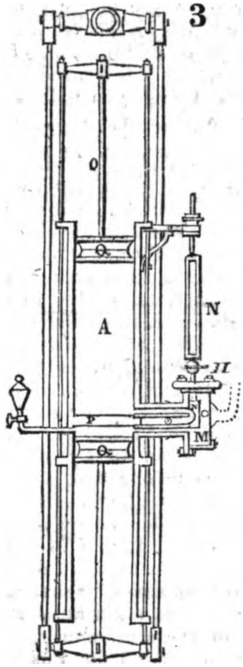

do away the chicanery of engine builders, and enable every one to judge for himself, whether the steam and atmospheric engine is not superior to all others.

NATIONAL REPOSITORY.

This exhibition of "specimens of new and improved productions of the artizans and manufacturers of the United Kingdom," is now open. Residing at some distance from town, we have not yet visited it ourselves, and have not felt much induced, by the accounts we have seen in the newspapers, to make a journey to London on purpose. With one journalist, the chief object of admiration is a model of a chapel (a manufacture, forsooth!); with another, the display of a number of weavers in the very act of weaving most suberb specimens of Gros de Naples!! (If the exhibition at Romani's cheap hosiery shop, Cheapside, of a stocking-weaver working at his loom, is quackery, what is this?)

The most favourable, and at the same time most candid, account of the affair which we have met with, is that contained in the "Literary Gazette;" and with this we hope our readers will be satisfied, till we can ourselves speak of it from personal inspection.

Our readers will not fail to observe the accordance, in many points, between the opinions of the writer of this account, and those which we have expressed on the subject on two former occasions (No. 244, p. 195, and No. 251, p. 388).

(From the "Literary Gazette," Saturday, 28th June.)

"NATIONAL REPOSITORY, CHARING CROSS.

"On Monday this new and patriotic design was thrown open to view, and a great number of persons of all ranks, from the peer to the artisan, hastened to visit and inspect the Exhibition. The extensive gallery, which runs from end to end of the King's Mews, has been very neatly fitted up for this purpose; and various articles of curious and highly-wrought manufactures, models of looms, bridges, &c. &c., and specimens of useful and improved articles for domestic comfort or foreign commerce, were arranged, with labels descriptive of the peculiar qualities which obtained them admission.

"Excellent as this plan appears to us to be, it does not seem to have at first taken the deep and wide root which we should have expected. The English people are either slow to move in such matters, or their habits lead more to separate and individual exertion in the way of trade, than to national and congregate efforts. Yet no one can doubt but that a Repository like this, under judicious management, may be made to contribute most essentially not only to private interests but to general benefits. The wealthy spe-

culator, manufacturer, and tradesman, may have sufficient power to publish the merits of his products, and push his adventures throughout the community; but the poor ingenious man is often doomed to toil in obscurity, while his clever devices and improvements are lost to society. To the latter class, a public depôt must be an object of the utmost importance; and we are rather surprised at *seeing so few instances in these rooms of their having availed themselves of the facilities it affords them.* Perhaps as the thing becomes better known,—to which we trust this notice will conduce,—the authors of mechanical and other useful inventions will pour in their contributions, and avail themselves of the opportunity of serving themselves, at the same time that they may promote the credit and advantage of their country. One obstacle certainly intervenes to prevent this in a considerable degree; we allude to the jealousy with which inventors and projectors regard their own suggestions. They are afraid of their ideas being stolen and appropriated by others; and hardly hope to protect, when openly displayed, what all the guards of patent rights so obviously fail to shield from infringement. As there is much force in this objection, at least to the exhibition of *novelties*, it is desirable that some rules should be laid down to save them from invasion, for their original proprietors. In other respects, we look to see this collection gradually enriched with the productions of British ingenuity, till it assumes a very prominent place among our public institutions. Already it boasts of beautifully executed works in chasing, cutlery, &c.; of weaving in silks of remarkable patterns, &c., with the "operative" employed; of models of engines and machinery for many purposes; of little-known manufactures; and, in short, of a multitude of curiosities well calculated to interest the visitor, and to induce practical results favourable to British arts and British commerce."

BARTON'S METALLIC PISTONS.

Sir,—Actuated by a desire to see justice done to every invention whose merits tend to the public good, I take leave to offer a few remarks on an article in your Magazine, of the 17th ult., headed "Improved Steam Pistons," and beg you will favour them with a place in your forthcoming Number.

Your correspondent Mr. Reed, it seems, has discovered a piston which he considers superior to a long-tried and decidedly the best metallic piston ever used in this country, viz. Mr. Barton's; but not content with this superiority, he wishes to convince us that Mr. Barton's, though extensively used, and found to give general satisfaction, is, in fact, decidedly injurious, inasmuch as it destroys the cylinder of the engine to which it is applied; and he refers to a statement made by Dr. Gregory, on the piston in question, as a corroboration of what he asserts.

Now, Mr. Editor, I have no hesitation in saying, that if in any instance the cylinder to which Barton's piston has been applied was found in the state alluded to, it must be attributed to the workmanship, and not the principle. I say this much from personal information, having watched its progress for many years, considering it to be a highly ingenious invention. I have also seen pistons made by the *patentee himself*, after two to eight years constant operation, but have never found the slightest complaint made against them; on the contrary, the gentlemen who have adopted them have bestowed on them the greatest praise, having worked well to the last; indeed, *they actually improve by wear.* Let us now refer to Mr. Reed.

That gentleman says, "that about two years since I made THREE pistons on Mr. Barton's principle, of nearly six inches in diameter. When ONE of them had been at work some time, I found the cylinder exactly as Dr. Gregory describes, *worn into furrows.* The workmanship," he goes on to state, "*I am sure was not in fault, for I made the pistons*

myself!" Mr. R. no doubt possesses talents of the first water, and is, I dare say, a *perfect mechanic;* but it is evident from the foregoing that he is not overburdened with modesty. I again repeat, that if the cylinder was in the state represented, it was the *workmanship*, and not the principle, of the piston, that was in fault. What became of Mr. R.'s other pistons? For some reason or other he does not inform us. Perhaps they were better constructed than the first, and answered his purpose, and left no room for condemnation.*

With respect to the piston proposed by Mr. Reed, I am of opinion that it possesses the faults of many gone before it, and will not be found to answer in practice. My reasons for entertaining this opinion I will communicate to you at a future period.

I forward to you certificates from a few out of the many gentlemen of the highest respectability who have adopted Mr. Barton's piston (they are also in use at the Royal Yards, Portsmouth and Woolwich, Thames Tunnel, &c.); from the perusal of which I am inclined to think you will agree with me, that an invention of so much merit is above the censure of your St. Petersburgh correspondent, although backed by a statement made by Dr. Gregory (when and where I know not). †

I am, Sir,
Your obedient Servant,
W. WYATT.

London, June 23, 1828.

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* We hope our readers will not forget that Mr. Reed lives at some distance—on the banks of the Neva,—and may not therefore be able, for a considerable time, to see and to reply to these animadversions; of which we cannot help observing, in the meanwhile, that they seem to us to betray a very singular want of candour.—EDIT.

† Dr. Gregory was not examined as a witness in the cause Barton *v.* Hall and Co., but gave the opinion to which allusion has been made, on a case that was submitted to him professionally; and it was afterwards published in the "Repertory of Arts."—EDIT.

The certificates referred to by Mr. Wyatt are from Mr. Smart, Messrs. Thornhill and Morley, Mr. Peto, Mr. George Ledger, Mr. James Hendry, Mr. William Howard, Mr. Herbert Allen, Messrs. Lean and Co., Messrs. T. V. Cooke and Co., Mr. Daniel Smith, Mr. R. W. Cope, and Mr. J. Jones; and all speak in very flattering terms of the merits of Mr. Barton's pistons. We must decline at present offering any opinion of our own respecting them; and shall only remark, that we see nothing in this array of names, which should place the invention in question above any censure which has fact for its basis, or that should render the scientific opinions of Dr. Gregory undeserving of the respect in which they have been so long indisputably held.—EDIT.

SELF-REGULATING CALENDARS.

Sir,—Mr. Woollgar having requested an explanation why just twenty-four divisions are necessary for the months in his own and Mr. Laurance's calendar, I beg to offer the following view of the case:—

As there are seven days in a week, on any one of which any particular month may commence in the different years, it follows, that if we make the column of any month slide from 1 to 7, there will be six new columns introduced, which make thirteen columns necessary. But there must be another set of thirteen columns, for leap-years, because the list of months beginning on the same week days is different in leap-years and common years, having only two consecutive columns which agree in each set, viz. *June* and *Sept. Dec.* Hence, if we place each set of thirteen compartments in the periphery of a circle, we can make them overlap or dovetail with respect to the above two columns; which reduces the *twice* 13, or 26, to 24 compartments; being the least number possible, according to this method of placing the months. But if we were to place lists of the months in the different radii of a circle, we need have no more than fourteen columns,—seven for common, and

seven for leap years. In this case, however, there must be the inscription of more months on the moveable card; fourteen complete lists of the twelve months being then necessary, though only one list would appear for any one year.

I have made one as a chimney ornament, in the following way:—Two paper cylinders are made to slide easily, one within the other and a slit or opening, of the width of one fourteenth of the circumference, is cut in the outer cylinder, through which is visible any one of the 14 lists of months, placed in perpendicular columns on the surface of the inner cylinder, with the proper year, or years. The front of the outer cylinder has a table of the week-days on the right hand side of the opening, and the monthly figures below. I have also cut the inner cylinder into two parts; and the lower part, being moved round and set for any year, shows, through spaces under a list of months in the outer cylinder, the days of new and full moon in each month of the given year; and this for any year in the present century. Should any of your readers attempt to make one of these, and fail for want of further explanation, I shall be happy to give it, and would send you a descriptive drawing, &c.

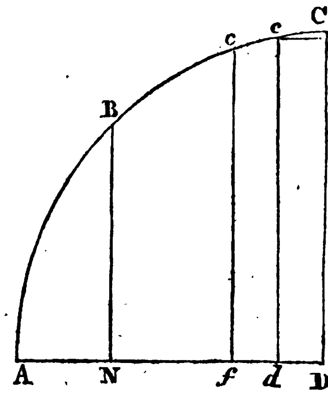
I am, Sir,
Yours, &c.
VECTIS.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(*Continued from p.* 377.)

In the differential calculus, the quantities, in general, are not supposed to be generated by motion, but to be made up of infinitely small component parts:—

Thus a finite curvilinear area A C D is not, as in the fluxional calculus, supposed to be generated by the motion of the variable line N B along A D. This, say the advocates of the differential system, is an un-



philosophical, illegitimate way of considering the matter: velocity is a consideration quite foreign and extraneous to the subject in question; but it is perfectly correct to consider it as made up of a number of small curvilinear areas *e f d o*. Now, if we take the portion A *c d* away from the whole area A C D, the difference between the two is represented by the small area C *c d* D which differs but little from the parallelogram C *d* D *o*; and the greater the number of these small curvilinear areas the whole is divided into, the smaller will be the error in considering the parallelogram itself as the difference between the two areas C A D, *c* A *d*; and if we continue the subdivision without end, or suppose the curve to be divided into an infinite number of these small parts, we shall reduce the error itself to a quantity which is infinitely small, and thus may be neglected.

To distinguish this infinitely small rectangular parallelogram, of which we have spoken, from the difference to which it is so nearly equal, it is called the Differential, and thus gives name to the Differential Calculus; the reverse of which, or the Integral Calculus, as it is called, which corresponds to the finding of fluents, consists in finding the sum or integral of these differentials. The rules by which these differentials and integrals, are to be found, are pre-

cisely the same as the rules for finding fluxions and fluents; but it is evident that there is a wide difference in the principles. Fluxions are finite assignable quantities; differentials are infinitely small, or, as it is called, evanescent, or vanishing quantities. A correct geometrical representation may be made of the one depicting its exact magnitude and figure, but it is impossible to give such a representation of the other; for as soon as it was made, we might reduce it to one still smaller. Thus it appears, that of a fluxion we may have a clear and distinct idea, but that we can form no such conception of a differential. As long as we reason about it as if it were a finite assignable quantity, our ideas are clear, but our conclusions are inaccurate, when we treat them as evanescent, or infinitely small quantities, our conclusions are, indeed, most perfectly correct, but we have lost sight of the means by which we obtained them.

This, it is true, does not invalidate the reasoning on the subject, but it renders it in some measure obscure, and certainly difficult; whereas, in the fluxional method, we do not lose the advantage of an illustration by a figure, which a celebrated writer (Locke) regards as one of the greatest advantages which the mathematical possess over the other sciences.

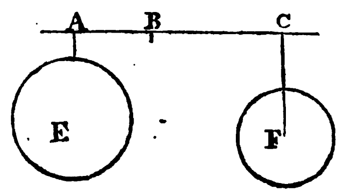
In the fluxional method, it is not necessary to suppose the increments y_1-y and h actually to vanish, and $\frac{y_1-y}{h}$ to become of the form $\frac{0}{0}$. We never make $\frac{y_1-y}{h}$ actually equal to the ratio to which it approximates.

Though by thus diminishing h we continually change the value of $\frac{y_1-h}{h}$ $(y_1-y : h)$ yet we only make it *approximate* closer and closer to a ratio whose terms are not affected by the variation of y_1-y and h; to a ratio, in short, which limits the ratio $\frac{y_1-y}{h}$ as the standard height limits the altitude of the mercury in the barometer.

If we can find two ratios, which thus limit the ratio $\frac{y_1-y}{h}$ of the variable quantities y_1-y and h, we conclude these ratios to be equal; and it is from this consideration that we have found the fluxions of such quantities as x^n.

By diminishing h very much, y_1-y and h become very minute, but still the ratio $\frac{y_1-y}{h}$ remain finite, as appears from the following illustration.

Suppose two globes E and F,



which are full of an elastic fluid, like air, to be suspended from the arms B and C of a lever, so as to balance each other, the one being at the distance (a), the other at the distance (b), from B, which is the fulcrum of the lever; suppose the vessels in which this fluid is contained, and the lever on which they are balanced, to be without weight and in a vacuum, and the instrument to be so contrived, that the air in the two globes may be simultaneously exhausted; it is manifest, that however we diminish the rarity of the air, still, as quantities proportional to the whole fluid in E and F are taken out at each stroke, the equilibrium will not be destroyed, and the proportion between the weights of the remaining fluid will not be affected, but will remain equal to $b : a$, even though we continue the operation of pumping for ever; which clearly proves, that, though the terms of a ratio or fraction are so small, that we can no longer be sensible of their existence, yet the fraction or ratio itself may be finite.

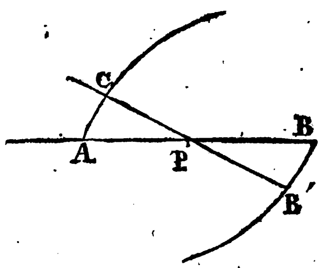
(*To be continued.*)

SOLUTION OF THE PROBLEM PROPOSED BY MR. JOPLING, (No. 247, p. 250).

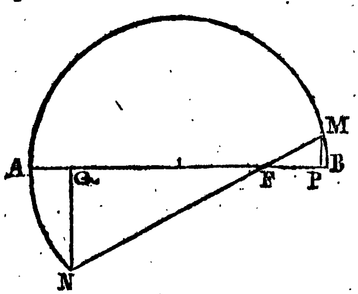
(Translation from the French of our Correspondent.)

Sir,—Whatever may be the given curve, the generating straight line C B' will furnish us, for the engendered curve, with this general equation:—

$$C B' - C P = P. B';$$
$$\text{or } m - v = z.$$



In the case of the proposed problem, A B is the diameter of the given semicircle; F is the pole; B is the describing point. What is required is the equation of the curve engendered by A B, while the point A traverses the semi-circumference.



Let A B $=2a$, B F $=c$, and B P $=x$, P M $=Y$: the equation of the circle is

$$Y=\sqrt{2ax-x^2}.$$

Now let F N $=z$, F M $=v$, we have

$$F P = F B - P B = c - x.$$

The rectangular triangle F P M gives

$$F M=\sqrt{P M^2+F P^2};$$
$$\text{or } v=\sqrt{2ax-2cx+c^2}.$$

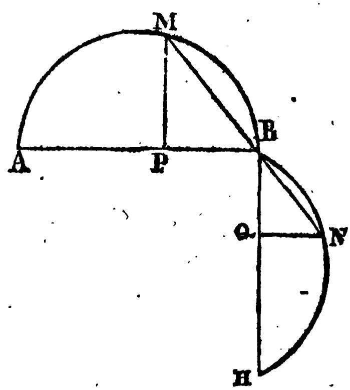
The general equation $m-v=z$, becomes then, m being $=2a$, $2a-\sqrt{2ax-2cx+c^2}=z$.

If the pole F becomes identified with the describing point B, in that case $c=o$, and the preceding equation is reduced to

$$2a-\sqrt{2ax}=z \ldots (1).$$

It becomes now necessary to obtain the equation of the engendered curve. For this purpose, let us produce B H perpendicular to A B, and it will be equal to it, since it is the generant in its last position. When it is in the position N B M, if we incline the perpendicular N Q upon B H, and the perpendicular P M on A B, thus making B Q $=u$, and Q N $=s$, we have

$$B N=\sqrt{B Q^2+Q N^2};$$
$$\text{or } z=\sqrt{u^2+s^2}.$$



In virtue of the similar triangles B N Q, B M P, we have the proportion B P : P M = N Q : B Q;

$$\text{or } x : \sqrt{2ax-x^2}=s : u;$$
$$\text{or } x \,.\, 2a-x=s^2 : u^2.$$

Whence we obtain

$$x=\frac{2as^2}{u^2+s^2}.$$

The values of x and z being substituted in the equation (1) we have

$$2a-\frac{\sqrt{4a^2s^2}}{\sqrt{u^2+s^2}}=\sqrt{u^2+s^2}.$$

Multiplying the whole by $\sqrt{u^2+s^2}$, it becomes

$$2a\sqrt{u^2+s^2}-\sqrt{4a^2s^2}=u^2+s^2;$$
$$\text{or } 2a\sqrt{u^2+s^2}=u^2+s^2+2as.$$

Raising the whole to the square root, and by transposition we have this equation of the fourth degree:

$$s^4+4\,a\,s^3+2\,u^2\,s^2+4\,a\,s\,u^2-4\,a^2\,u^2+u^4=o.$$

This equation of the fourth degree is of the same form as that which Maclaurin found by a very different process. It belongs to an epicycloid, as that celebrated geometer has demonstrated ("Geom. Organ." p. 100). In fact, this curve is absolutely the same as the epicycloid engendered by two equal circles, the diameter of which is $2\,a$.

In another letter I will speak of the snail of Pascal *(limaçon de Pascal)*, so improperly named a *cardioid*, since that curve resembles more a *shell* than a *heart*. It was known, besides, before the time of M. Carré, who did not even invent the name, which he received from Castillon.

The history of the sciences offers many examples of this sort. An author attributes a discovery to one who never made it, others repeat his assertion, and it is thus error is propagated. F.

APPEARANCE OF FIGURES IN ICE.

Sir,—Were it only to offer additional observations in support of what I stated on this subject, page 13, I should certainly not have troubled you again; but the reply of Mr. Henry H., page 152, is so peremptory, and at the same time so irrelevant to the phenomenon in question, as to render a few remarks absolutely necessary.

Mr. H. says, "Water in the act of congelation, so far from *contracting* and becoming *heavier*, expands and becomes *lighter*." I say *granted*. But what has this to do with the process which I was describing, viz. the motion of the particles *before* congelation? The instant any of the particles were in the act of freezing,—that is, of adhering or becoming fixed,—I had done with them, and continued to describe the motion or change of those below. And does Mr. H. mean to affirm that these, also, were expanding and becoming lighter? If he *does*, I presume he equally maintains the converse, that the *warmer* the water, the more its *contraction;* and consequently, that an increase of heat diminishes the bulk, in consequence of *contraction* of the particles, instead of their *evaporation!!*

Permit me, Sir, to quote from my own letter. "It is evident that the act of freezing will take place sooner, and the ice be thicker, in shallow than in deep water." Now it is this that occasions the appearance of the objects in the ice; and I did not wish to lengthen unnecessarily my explanation, by noticing the *apparent* expansion of the ice itself, with respect to the water of which it was formed, because the process I was describing terminated with regard to each particle, on its immediate congelation. And whatever be the ratio of expansion in ice, it is probably the same in all its parts, and does not take place in consequence of increase of *bulk* in the atoms, but arises from an alteration in their *shape* in crystallization.

I have only to add, Sir, that the readers of the "Mechanics' Magazine" are, of course, at liberty to embrace or reject my hypothesis on this subject; but, in either case, I trust they will consider that I have advanced nothing opposed to the phenomena of nature, of which I have been so flatly accused.

In conclusion, I cannot refrain from noticing the very perspicuous and intelligent communication of Mr. S. Chalgrave, page 75. Under the circumstances described by him, I presume there would be figures or appearances in the ice; but Mr. Hugill's account seems to me to imply that the falling of rain occasioned, either wholly or in part, the rise of the water in the well. If this were the case, I think the impurities, &c. mentioned by Mr. Chalgrave, would have been thereby dispersed, and the clusters in form of the objects would not have been re-produced on the quiescence of the surface of the water.

I am, Sir, yours, &c.
VECTIS.

WHEEL CARRIAGES.

Sir,—I beg leave to solicit, through the medium of the "Mechanics' Magazine," an answer to the following queries:—

Whether a waggon, or other carriage of four wheels of equal diameter, is not of lighter draught than those commonly used, having the fore or front pair of wheels of a diameter less than the hind?

Whether, at all events, the diameter of the front wheels should not be of that size as to place the axle upon a line with the point of the horse's shoulder, so that the power of the horse, which is generally admitted, I believe, to lie at the point of the shoulder, should be upon a level with the weight to be moved?

As front wheels are generally constructed, the axle lies much beneath the horse's shoulder; and he, consequently, has to pull upwards, or, apparently, to lift from the axle.

It appears to the querist that the axle should be on a level with the shoulder, if not higher; and that it would be easier to pull down from the centre of the wheel than to pull up from it.

The subject may be, perhaps, of practical utility, and with that view the questions are asked.

I am, Sir,
Yours, &c.
HENRY JOHNSON.

London.

DEPOSIT IN STEAM-BOILERS.

Sir,—A short time ago a friend of mine placed on the bottom of his steam-engine boiler a tin vessel, of twelve inches diameter; and on examination at the end of three weeks, it was found to contain a heavy deposit, resembling clay, of the depth of fourteen inches; at the same time every other part of the boiler bottom, as well as that immediately contiguous to the above-mentioned vessel, was covered with a similar deposit, which *nowhere exceeded* three inches in thickness.

I shall feel obliged if any of your numerous scientific correspondents will account for this extraordinary difference in the thickness of the deposit; namely, that it should be *fourteen inches within* the vessel, whilst OUTSIDE *it was only three.*

I am, Sir,
Yours, &c.
C. R.

Huddersfield.

NEW PUBLICATIONS

Connected with the Arts and Sciences.

Practical Geometry; in a Series of Letters, for the Use of Mechanics. By A. DOULL. 64 pp. 18mo. Burrill, Chatham.

WE see no ground for Mr. Doull's assertion (Preface) that Practical Geometry is (in the year 1828) to a great extent, "either neglected or much undervalued," among mechanics; and cannot even conceive the possibility of persons of this class cultivating industriously "a knowledge of the higher branches of mathematical science, who cannot define the more obvious properties of the circle or triangle." Colonel Pasley's Practical Geometry, Dr. Gregory's Mathematics for Practical Men, the English translation of Baron Dupin's Geometry of the Arts, superintended by Dr. Birkbeck, most of Mr. Peter Nicholson's works, and our own little hebdominal—among the multifarious contents of which, the practical applications of Geometry have always held a prominent place,—are all so many evidences of zealous efforts having been made, and being still making, to diffuse this description of information among workmen. The extensive circulation, too, which some of these works have obtained, establishes equally clearly the more important fact—that there prevails among mechanics a very general and earnest desire to profit by the sort of instruction which they contain. If there be persons who foolishly throw away on the speculative parts of geometry, time and labour that would be more profitably devoted to the study of its practical uses, they are to be sought for in schools and colleges, rather than in workshops and manufactories.

We have, at the same time, no difficulty in allowing that the field is yet open enough for such a Treatise on Practical Geometry as Mr. Doull informs us he has made it his study to produce. "The present work has been undertaken with a view to present the young mechanic or apprentice with a *distinct* and concise

treatise on Practical Geometry, *at a small expense;* and sufficiently explicit to enable him to prosecute the study of so useful a branch of practical knowledge, at his convenience, without the aid of a teacher."—Preface, p. v. The works of Pasley, Gregory, Dupin, &c. (as we have more than once before remarked) are all too bulky and too dear (though cheap, in relation to their bulk) for the generality of mechanics.

Mr. Doull has given his treatise an epistolary form, "in order, if possible, to divest the subject of that dry stiffness and sameness of expression," in which it is so commonly shrouded. He seems to have taken Cobbett, in his Grammars, for his model, and so far as plainness and sound sense are concerned, he could not have taken a better.

In Letter I. Mr. D. gives some general advice on the subject of mathematical studies, which is well worth the attention of all mechanics:—

"The extensive science of Mathematics lies partially open before you; and I am about making an attempt to reduce its introductory branch to a form not superior to the weakest capacity. But, notwithstanding all the care I have taken to make everything clear, it will still be necessary for you to be very attentive and persevering. Do not willingly give up anything, until you have a thorough knowledge of it. In learning a problem or two, when you retire from the shop, you will be urged forward when you perceive the great affinity there exists between your daily occupations and your evening studies. But, though you may not perceive the direct application of every problem you learn, do not, on that account, regard the problem as useless; for, as you advance in a knowledge of the science, its extensive usefulness will become more apparent.

"In order to go through this course, you must provide yourself with some stout paper, a case of mathematical instruments, containing compasses, drawing-pens, scales, &c.; a flat ruler, and a triangular piece of wood, having one of its angles a right angle: this latter being a convenient instrument for mechanically raising perpendiculars, or drawing parallel lines.

"To save expense, a slate without a frame, may be used instead of paper; and a compass, with one leg fitted to hold a slate pencil, in lieu of the case of instruments referred to. But I would just observe, that by using a slate, you will acquire a habit of pressing heavily upon your compass, and will afterwards require considerable practice to draw neatly on paper; whereas, in using paper, your figures will gradually be acquiring a degree of neatness, as you become acquainted with the use of your instruments; so that, when you commence plan-drawing, you will have acquired a neatness of delineation, which will be beneficial and encouraging. By preserving your figures, you have the advantage of glancing your eye over them occasionally, to refresh your memory.

"In attaining a thorough knowlege of the Definitions and Problems, much will depend upon a strict adherence to the instructions laid down. The definitions, which may be considered the language of Geometry, ought to be committed to memory; or at least to be so far understood, as to enable you to give an explanation of the terms of the art, in proper language. In acquiring a knowledge of the definitions, do not satisfy yourself with merely fixing the words in your memory: ponder over them until your understanding is informed."

Mr. D., in his *definitions* of the terms used in Geometry, has proceeded on a principle of tangibility, and thus avoided all those hair-splitting subtleties on the subject, which have so often proved stumbling-blocks to both teachers and learners. He defines a point to be "that which has position, but no *measurable* dimensions;" a line to be "that which has length, but no *measurable* breadth or thickness;" a superficies or surface to be "that which has length and breadth, but no *measurable* thickness;" and so on. No person can have the smallest difficulty in comprehending perfectly such definitions as these, and even the most imaginative theorist must allow, that as far as regards *Practical* Geometry at least, they leave nothing to desire, in point either of significancy or plainness.

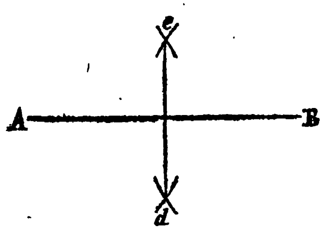
The *Problems*—fifty-eight in all—are such as the author has supposed likely to be "most useful." We cannot, however, commend the judgment which he has shown in the selection; several of his Problems are of far inferior importance to others which might have filled their place: some only occupy space to no purpose; and, generally speaking, they are all too much of the nature of mere abstract exercises, instead of being drawn, as they should have been, from the actual practice of the arts. As an instance of all these faults, we may mention his employing two Problems (I. and II.) and five modes of solution (one

of them, the first, erroneous) to show precisely the same thing, namely, how one line, C D, may be drawn parallel to another, A B. He would have done better, surely, had he given one abstract method of construction only, and added some familiar examples of its practical application, such as how the instrument known by the name of a straight-edge, may be proved to be exactly a straight; or how a perfect mitre-square may be constructed.

Neither, we regret to say, are Mr. D.'s methods of solving such Problems as are most undoubtedly useful, always the most correct and practical: some of his failures in this respect we feel particularly called upon to notice.

Problem VIII. requires the learner "*to bisect the given line A B*;" and it is one on which the solution of many other important Problems turns. Mr. D.'s method is as follows:—

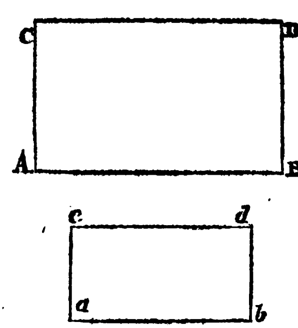
"From A and B, as centres, with any convenient radius, describe two small arcs, intersecting each other in the points *c* and *d*.



"Join these points by a right line, which will bisect or divide the given line A B into two equal parts: as also be perpendicular to it."

The faults of this demonstration are extremely obvious. A learner would be led, at first sight, to infer from it, that "any convenient radius," or, in other words, any one of several radii will, with A and B as centres, produce two arcs intersecting each other in the points *c* and *d*; whereas there is but one radius that will produce these points. Neither is there any rule laid down by which a person could, in every case, find the particular radius that would produce points corresponding with the *c* and *d* of the demonstration. We defy any one, indeed, who looks to Mr. Doull's directions alone, to turn them to any practical account in the bisecting of lines. The reason is, that he has only given one example of a general principle of construction, and left that principle itself quite out of sight. What he should have said was, that with any radius *greater than the half of the line* A B (which the eye can easily determine), you may draw from A and B, as centres, two arcs which will intersect each other in two points, a straight line between which will pass through the centre of the line A B; and, for this obvious reason, that as both arcs are described by the same radius, and that radius is greater than the half of the line A B, they must be at the same distance precisely from the centre of that line. Once informed of the principle of the thing, the student would, of course, have perceived, that instead of the middle of the line A B being only to be determined by finding out the two identical points of intersection, *c* and *d* (as Mr. Doull's present mode of stating the case might lead one to suppose), it may be as easily determined by a hundred or a thousand other points similarly produced.

Problem XXXVII. is in these words: "The rectangle A B C D given, to draw a similar rectangle *a b c d*, on half the scale." The following is Mr. D.'s method:—



"Make *a b* equal to half A B. From *a*, raise a perpendicular *a c*, equal to half A C; from *b*, a perpendicular *b d*, equal to half B D; and join *c d*, which completes the rectangle."

Now, to what else do these very learned instructions amount, than simply this,—that to produce a rectangle half the size of another rectangle, you must make it of half the size? It has been the purpose, it is true, of a preceding Problem, to teach you how you may "make *a b* equal to half A B," &c.; but we have just shown how completely it has failed in doing so. There is nothing in the directions there given which could enable any one to bisect the sides of the given rectangle in the present case.

We might easily add to these examples, but we forbear. We should not have taken the pains we have done with Mr. D.'s work, were it not that we think him entitled, in spite of all its defects, to much praise and to every encouragement. The field, as we have said, is open for a labourer of this cast, and we should be sorry were any remarks of ours to drive him from it. The design of his work is excellent—the style of it good—much of the matter of it unexceptionable,—and if he will but so far take what we have said in good part, as to revise it carefully, and give it, throughout, a more practical character, he may yet render it worthy of universal favour. We have hinted that Mr. D. has made Cobbett his model; when it can be said of him, that he has done for Geometry what Cobbett has done for Grammar—that he has followed his prototype *passibus equis*,—he will have established for himself a strong claim on the gratitude of the rising generation of mechanics and tradesmen.

A Practical Explanation of the Elements of Architecture, for the Use of Drawing Academies and Mechanics' Institutions. By Geo. Smith, Architect, Lecturer on Architecture at the Edinburgh School of Arts. 36 pp. 18mo. With Seven Copper-plate Engravings.

The laudable object of this little work is "to furnish Mechanics, at the lowest possible price, with an Elementary Introduction to the Orders of Architecture, both Grecian and Roman." As far as it goes, it will be found an equally cheap (only 2*s*. 6*d*.) and efficient guide; simple, perspicuous, and correct. The author treats first of the parts which compose the orders of architecture; then of the orders themselves—Tuscan, Doric, Ionic, Corinthian, Composite; next of the height of columns, proportion of entablatures, pilasters, and pedestals; and concludes by recapitulating, in the form of question and answer, the principal points laid down in his preceding sections. The only fault we have to find with the work is, that the author has confined his attention so exclusively to Grecian and Roman orders. He speaks of these as if they were the only orders that ever existed; and as if neither Egyptian, Hindoo, Arabian, nor Gothic architecture furnished a single model worthy of imitation. Mr. Smith would do well, in any future edition of his work, to give it a more comprehensive range.

MISCELLANEOUS NOTICES.

Power of Man to endure Heat.—An experiment to ascertain the degrees of heat which it is possible for a man to bear, was made a few days ago at the New Tivoli, Paris, in the presence of a company of about 200 persons, who had been specially invited to attend by Dr. Robertson, director of that establishment. The man on whom the experiment was made, is a Spaniard of Andalusia, named Martinez, aged 43. A cylindrical oven, constructed in the shape of a dome, had been heated for four hours, by a very powerful fire. At ten minutes past eight, the Spaniard, having on large pantaloons of red flannel, a thick cloak also of flannel, and a large felt, after the fashion of straw hats, got into the oven, where he remained seated on a footstool, during fourteen minutes, exposed to a heat of from 45 to 50° of a metallic thermometer, the graduation of which did not go higher than 50. He sung a Spanish song while a fowl was roasted by his side. At his coming out of the oven, the physicians found that his pulse beat 134 pulsations a minute, though it was but 72 at his going in. The oven being heated anew for a second experiment, the Spaniard re-entered, and seated himself in the same attitude at three quarters past eight, ate the fowl, and drank a bottle of wine, to the health of the spectators. At coming out, his pulse was 176, and the thermometer indicated a heat of 110 degrees Reaumur. Finally, for the third and last experiment, which almost followed the second, he was stretched on a plank surrounded with lighted candles, and thus put into the oven, the mouth of which was this time closed. He was there nearly five minutes, when all the spectators cried out "enough, enough," and anxiously hastened to take him out. A noxious and suffocating vapour of tallow filled the inside of the oven, and all the candles were extinguished and melted. The Spaniard, whose pulse was 200 at coming out, immediately threw himself into a cold bath, and in two or three minutes was on his feet safe and sound.—*Paris Paper.*

Society of Civil Engineers.—The Institution of Civil Engineers, of which Mr. Telford is President, has received a charter of incorporation from the crown. The objects of the Institution, as recited in the charter are, "the general advancement of mechanical science, and more particularly the acquirement of that species of knowledge, which constitutes the profession of a civil engineer; being the art of directing the great sources of power in nature, for the use and convenience of man, as the means of production and of traffic in states, both for external and internal trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation, and locks for internal intercourse and exchange, and in the construction of ports, harbours, moles, breakwaters, and lighthouses; and in the art of navigation by artificial power, for the purposes of commerce; and in the construction and adaptation of machinery, and in the drainage of cities and towns."

Queen of Pearls.—Dr. Fischer, of Moscow, in a work which he has recently published on the "Pearl Fisheries of Russia," describes a pearl, which is now in the possession of a Greek merchant, residing at Moscow, of the name of Zozima, which, he says, has not perhaps its equal. It was brought from the East Indies, and is kept in a rich casket. It weighs 27¼ carats, almost a quarter of an ounce; it is perfectly spherical, and of a brilliancy surpassing that of the most highly polished silver; it is transparent, and so smooth, that when placed on a level surface, it continues rolling about like quicksilver.

Storks.—It is well known that storks generally build their nests on the highest parts of buildings or trees. Two of the species, who have been for

some years in the Royal Menagerie at Paris, without exhibiting any disposition to produce offspring, this year built their nest in a bush, on the ground. The female laid five eggs, which she sat upon for thirty-one days, at the expiration of which time five young storks came forth, and have been treated with great care by their parents. The larger kinds of wild birds, when placed in situations not natural to them, very seldom show any wish to produce young; and some great change in their habits seems necessary for that purpose.

Jocular and Scientific Tenure.—The Lord of the Manor of Effingham is bound by his tenure to drive a goose, every New Year's day, three times round the hall of the Lord of Hilton, while Jack of Hilton blows the fire. By this Jack of Hilton, was meant an æolopile in the form of a human figure; similar, probably, to the one of this description described in the Archæologia, vol. xiii. p. 410.

The Florentine Agate Workers slit their agates and other stones, by a bow with an iron wire and emery, into slices about an eighth of an inch thick; the iron wire effecting the same purpose as the thin iron wheel of our lapidaries.

Gazelles.—The menagerie of the Museum of Natural History at Paris has lately received the addition of two beautiful gazelles from Senegal. One is a male kevel, still young, but which already shows all the characteristics of its species; horns with double curves, fine fallow hair, a black tail, and black line on its flanks, and two white spots on the sides of its nose. The other is a female guib, which has no horns, and the fallow hair of which is agreeably varied by cross lines and white spots.—*Literary Gazette.*

MINOR CORRESPONDENCE.

Guttering of Candles.—Sir,—I observe in vol. ix. p. 46, an article on this subject. I think it unintelligible, and my friends and acquaintances, who have read it, think so too. Now, if it were fully explained, so that the alleged remedy might be made use of, a great benefit would be conferred on those who use a number of candles. Not only would the waste of tallow be prevented, but a great deal be gained in point of cleanliness. —I am, Sir, C. C., *South Petherton.*

Waggoner's Assistant.—Sir,—Be pleased to allow me to request a little more information on a subject, to me, of some interest. At p. 85, vol. viii. there is a description by "A. W.," of an invention, which he terms a Mechanical Agent for assisting Carts or Waggons to ascend hills. If such a thing can be applied in the manner, and to the purpose he speaks of, it will be very useful to me, and perhaps to many more; but as the drawing is on a small scale, and those portions of it which represent the hoop, the click, and the knob, are too obscure to enable me to see clearly their mode of operation, I shall be extremely obliged to "A. W." if he will give such further explanation of the whole, as will put it in the power of practical men to bring the contrivance into practice.—I am, &c. CREFTTWR.

Bleaching Muslins.—Sir,—This being the time of the year for white dresses, my wife and daughters are turning out their drawers, with a view of bringing such garments into use—but, alas! they are more or less yellow with laying by all the winter. "Papa, what shall I do to get this frock white?"—"Lay it on the grass, my dear."—"Why, dear me, it will take three months to make it a good colour."—"Get some bleaching liquid, then."—"Oh yes; but I cannot afford to give 2s. for half a pint of bleaching liquid, it would hardly be enough for one frock; you must tell us of something else, Papa." Thus, Mr. Editor, am I teased, first with one, then the other. May I, therefore, request, Sir, through the medium of your valuable publication, information how to make a cheap bleaching liquid, not to injure the texture of muslin?—I am, &c., A SUBSCRIBER.—Our correspondent was right in recommending *the* bleaching liquid (liquid oxymuriate of lime), to his daughters. There is nothing which removes so effectually and speedily the yellow tinge which muslins acquire from being too much in use, or too long out of it. Neither is the expense such as any one need grudge; no more than a teaspoonful to each choppin of water being required. Muslins steeped in such a solution for a few days, and then thoroughly washed in pure water, will become beautifully white.—*Edit.*

Sir Richard Phillips.—Our Barton-upon-Humber correspondent, Mr. Harrison, who wishes us to open our pages to the discussion of this learned knight's philosophical vagaries, has himself furnished the best possible reason for declining to comply with his request. "It is certain," he says, "that any *mental affection*, which represents things in false lights, and consequently quite different from what they really are, is to the mind just what jaundiced eyes are to the body. Every thing appears yellow to jaundiced eyes, and it is plain, that the objects of Sir Richard Phillips' perception are really seen through a discoloured medium. Since facts, reason, daily experience, and common sense, have been all opposed to his vagaries over and over without avail; in short, he seems absolutely incorrigible and not to be reclaimed. It has been proved, time after time, that to reason with him is the same thing as to hold a lanthorn to the blind," &c. &c.

NEW PATENTS.

Thomas Aspenwall, of Bishopsgate-church-yard, London, Esq. for an improved method (communicated to him by a foreigner), for casting types, to be called the mechanical type caster.—22 May—6 months for enrolment.

Samuel Hall, of Bassford, cotton manufacturer, for an apparatus for generating steam, and various gases to produce motive power.—31 May—6 months.

James Moffat, of Coleman-street, London, master mariner, for an apparatus for stopping and securing chain cables; also, for weighing anchors attached to such chain or other cables, either with or without a messenger.—3 June—6 months.

INTERIM NOTICES.

We shall insert the paper of Inquisitor, but cannot promise it an early place.

Communications received from J. L. S.—Mr. M'Vay—Mr. Jopling—Mr. Baddeley—Mr. Utting—Delta—W. T.—G. F. D.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-Row, London.

Printed by G. Duckworth, 76, Fleet-street.

Mechanics' Magazine,

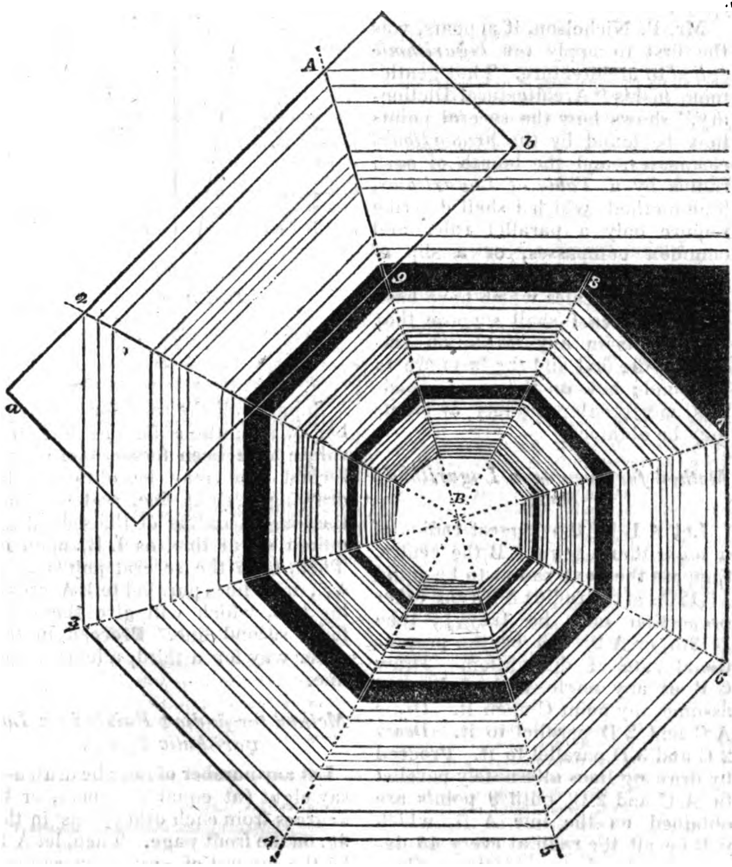
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 257.] SATURDAY, JULY 12, 1828. [Price 3*d*.

"No thought of the human soul was ever lost, but also no perfect skill came suddenly into existence, in this race as in animals. Consistently, therefore, with the whole economy, everything here takes a progressive course; nothing is immediately found out, like the construction of a hive; but all is continual discovery and operation, and all is striving onwards."

HERDER.

FORMATION OF SPIRALS.



METHOD OF FORMING A LOGARITHMIC SPIRAL SCALE, AND OF FINDING THE POINTS IN A LOGARITHMIC SPIRAL.

BY JOS. JOPLING, ESQ. ARCHITECT.

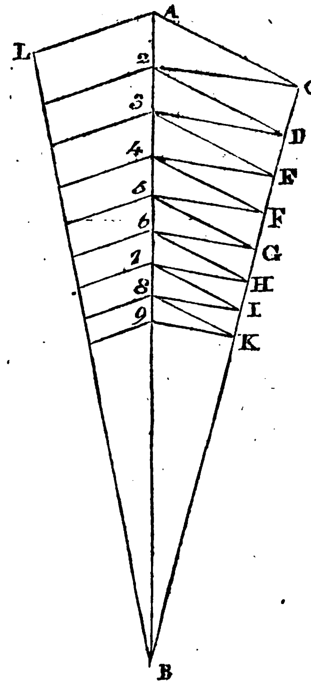
Sir,—It may not, perhaps, be altogether uninteresting to your readers to hear a little more respecting *spiral lines*. I have given you scales of the Greek volutes, and of the method of restoration, proposed by Mr. Inwood, for the volute of the Temple of Victory; and I beg now to add a scale of a *logarithmic spiral*, with easy *methods of forming a scale* of that kind, and *for finding points* in any logarithmic spiral, as well as some farther observations on Mr. Inwood's spiral.

Mr. P. Nicholson, it appears, was the first to apply the *logarithmic spiral* to architecture. That gentleman, in his "Architectural Dictionary," shows how the several points may be found by the *proportional compasses*, and the length of each radius by a *Table of Logarithms*. The methods which I shall describe require only a parallel ruler and common compasses, or a slip of paper.

As in the scales which have been given, so here I shall suppose that nine points in any revolution (including the first and the last) are to be found; but, on the same principles, any greater number of points may be obtained.

Method for forming a Logarithmic Scale.

Let A B be the longest radius of a logarithmic spiral; B the centre. Suppose the next radius to be equal 11-12ths of the radius A B (any other proportion may be taken); then 1-12th, or A 2, will be the proportional rate of diminution. Draw C B at any angle with A B, and assume any point C upon it. Draw A C and 2 D parallel to it. Draw 2 C and 3 D parallel to it. Proceed by drawing lines alternately parallel to A C and 2 C, until 9 points are obtained on the line A B, which will be all the radii at every 45 degrees for the first revolution. Continue the same process for a second, a third, &c. revolutions: indeed, it would require an infinite number of revolutions, before the spiral line would arrive at the centre B.



Suppose all the radii for any number of revolutions for one line in a volute have been found, those for a second line may be obtained by drawing a right line, and marking the longest radius of the second required spiral line, as L B, upon it. Then, from the several points 2, 3, &c., draw lines parallel to L A, crossing L B, which will give the radii for a second line. Proceed in the same way for a third, a fourth, &c. line.

Method for finding Points in a Logarithmic Spiral.

Let any number of radii be drawn—say eight (at equal distances, or 45 degrees from each other)—as in the fig. on the front page. Then, let A B be the longest of any given radius; and let 2 B be the second radius, in

any proportion less than the first. Next, place the edge of a ruler, or slip of paper, as *a b*, against the points 2 and A, and then mark the direction of the radius A B across the ruler or paper. Now move the ruler, and place the line drawn across it on the second radius 2 B, with the edge touching the point 2; and where the edge of the ruler crosses the third radius will be the third point. Proceed in the same way to obtain a fourth, a fifth, &c. points, until one revolution is completed.

Points in any number of revolutions may be found by continuing the same process, or by drawing lines parallel to the edge of the ruler, in the several positions in which it was placed for the first revolution. In like manner, if the position of any number of intermediate lines be assumed upon any radius, the several points, where they will cross all the other radii, may be found. This will be, it is thought, quite manifest by the figure, where, for the purpose of showing the principle, right lines are drawn from radius to radius. For other spirals, the edge of the ruler may be a curve, or the radii may be at unequal distances.

I have noticed that the method of finding points in a spiral line, proposed by Mr. Inwood, has not the Greek character; but it remains for me to show more minutely the description of line that is produced, and which is so strongly recommended by that gentleman. The following Tables have been formed for this purpose.

Table I.

Measures of the Spiral Space in the Direction of each Radii.	Diameter of Eye.		Radii.	Variation in Radii.
24+16+8+	7	=	55	
23+15+7+	7	=	52	
22+14+6+	7	=	49	
21+13+5+	7	=	46	
20+12+4+	7	=	43	3
19+11+3+	7	=	40	
18+10+2+	7	=	37	
17+ 9+1+	7	=	34	
16+8+	7	=	31	
15+7+	7	=	29	
14+6+	7	=	27	
13+5+	7	=	25	
12+4+	7	=	23	2
11+3+	7	=	21	
10+2+	7	=	19	
9+1+	7	=	17	
8+	7	=	15	
7+	7	=	14	
6+	7	=	13	
5+	7	=	12	
4+	7	=	11	1
3+	7	=	10	
2+	7	=	9	
1+	7	=	8	
	7	=	7	

Table II.

Measures of the Spiral Space in the Direction of each Radii.	Diameter of Eye.		Radii.	Variation in Radii.
24+16+8+½+	7	=	55½	3¼
23+15+7+¼+	7	=	52¼	
22+14+6+0+	7	=	49	
21+13+5+0+	7	=	46	
20+12+4+0+	7	=	43	3
19+11+3+0+	7	=	40	
18+10+2+0+	7	=	37	
17+ 9+1+0+	7	=	34	2½
16+8+½+	7	=	31½	
15+7+¼+	7	=	29¼	2¼
14+6+0+	7	=	27	
13+5+0+	7	=	25	
12+4+0+	7	=	23	2
11+3+0+	7	=	21	
10+2+0+	7	=	19	
9+1+0+	7	=	17	1½
8+½+	7	=	15½	
7+¼+	7	=	14½	1¼
6+0+	7	=	13	
5+0+	7	=	12	
4+0+	7	=	11	1
3+0+	7	=	10	
2+0+	7	=	9	
1+0+	7	=	8	0½
½+	7	=	7½	
¼+	7	=	7¼	0¼
	7	=	7	

The first Table is the basis of Mr. Inwood's method; which, while it has a uniform variation in the spiral space, has sudden variations in the lengths of the radii in each succeeding revolution. The variation in the spiral space is uniformly *one part* in every 45 degrees; but, in the radii, the variation is *one part* in each 45 degrees for the first revolution, *two parts* for the second, and *three parts* for the third revolution.

Mr. Inwood appears to have been sensible that a spiral thus formed would not have the most pleasing appearance; he, therefore, commences with ¼, then ½ division, before he proceeds with the uniform variation of *one part* in the spiral space. The effect of this on the radii in each revolution will, it is thought, appear evident from Table 2. It is, in fact, like what is called a *reconciling sweep* in naval architecture.

Two of the radii	increase	¼ each
One	do.	½
Five	do.	1
Two	do.	1¼
One	do.	1½
Five	do.	2
Two	do.	2¼
One	do.	2½
Five	do.	3
Two	do.	3¼

With a knowledge of Mr. Nicholson's method (for, if I recollect aright, Mr. Nicholson's son made out the drawings for Mr. Inwood's publication), it is somewhat surprising that Mr. Inwood should have so strongly recommended a method so much more difficult in the application, so imperfect in principle, and so very unlike the Greek character.

Although I think it important to have a correct idea of a principle, and a knowledge of the simplest methods of application (which are my reasons for troubling you with this communication), it must not be supposed that I would recommend the application of any approximate methods for producing spirals, or, indeed, any other curve, if an instrument be at hand by which it may be drawn by continuous motion. And if your readers were familiarly acquainted with the several simple methods of generating curves, approximate methods would not be so frequently resorted to. I have, however, had it in contemplation to give you a list of all the methods I have heard of, as well as some methods of producing gradations of moulds; but as Mr. P. Nicholson, in his "School of Architecture and Engineering," has commenced that subject, I shall defer my communication for the present.

I am, Sir,
Yours, &c.
JOS. JOPLING.

FIRE-ESCAPES.

Sir,—I feel myself under much obligation for your prompt attention to my communication on the subject of forming a Society for preventing the Loss of Life by Fire; and am grateful to you and several of your correspondents for the manner in which each has been pleased to express their approval.

In consequence of the publicity given to my proposal, through your Magazine, I have received several valuable communications from highly respectable characters. Thus encouraged, I feel quite confident that whenever a public meeting may take place for the object above stated (and I trust that will be in a short space of time), the establishment of a Society will meet with general approbation.

The recent cases of fire, and the loss of life* by each, are lamentable proofs of the necessity for a regulated system, in this great metropolis, for its prevention; and further, that were a fire-escape placed in every house, it would not prevent the awful calamity. Neither can dependence be placed on the inmates to render assistance or alarm throughout a house on fire, in consequence of the terror and confusion of mind which usually take place. The

* No less than nine more lives have been lost since the subject was last under the notice of our readers.—EDIT.

blind, the lame, the bedridden—these require the assistance of men who have been trained in such a manner as will enable them coolly, collectedly, and effectually, to render aid in time of need. Such men would prevent the absurd practice of breaking open the lower part of a house on fire, before it was ascertained that the inmates had escaped.

Mr. Editor, allow me, in conclusion, to appeal to the good sense of every individual of the metropolis, by asking whether it be not of *equal* importance that a Society should be established for preventing the loss of life by fire, as well as a Society for preventing loss of life by drowning?

I am, Sir,
Yours, &c.
JOHN HUDSON.

85, Cheapside, June 26, 1828.

DOUGHTY'S RHODIUM PENS.

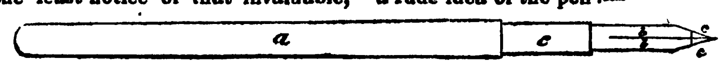
Sir,—I have been a constant subscriber to your entertaining Repository from its commencement, and have derived much information, amusement, and practical instruction, from its multifarious descriptions of inventions, improvements, and discoveries. But amongst your numerous and valuable contributors, I have not found one who has taken the least notice of that invaluable, useful, and delightful instrument, the pen.

The quill is the instrument now generally used for writing, but on account, chiefly, of its cheapness; for it is neither durable nor retains its spring, if long used; requiring so often to be mended, that a great loss of time is occasioned.

The quill pen with steel nibs, and the steel pen, are not good for much. The quill with steel nibs soon wears out, by the corrosion of the ink on the nibs; and the quill itself loses its elasticity, owing to the ink saturating it. The steel pen has little or no spring, soon corrodes, and scratches the paper very much.

Some time ago I wanted to obtain a pen that would not require mending, and tried the above, and several others, but found them all equally defective. I then purchased one of Doughty's rhodium pens,—and a most beautiful one it is. The nibs and shoulders are made of gold, and are tipped with rhodium. It has an excellent and lasting spring, forms most beautiful and clear strokes, and will write any size, from small hand to large text. It does not scratch the paper, as steel, silver, &c. do; it does not corrode by the ink, it having no action on it; and the points of the nibs are so hard as not to wear by the most continual use.

The following sketch may convey a rude idea of the pen:—



a the stem, made of ivory, silver, gold, &c.; *b b* the nibs, made of gold attached on a gold block *e*; *c c* pieces of rhodium attached to the nibs. This metal is as hard as the diamond, and consequently never requires mending.

Having trespassed thus far on your patience, I hope you will allow me to say *I am not interested*, by recommending this pen to your notice: the inventor, Doughty, is *unknown to me.* I have merely stated what I know is truth, and which I hope you will allow a place in your Journal.

I remain, Sir,
Yours, &c.
ROBERT JOHN THOMAS.

Princes-street,
March 19, 1828.

WEDGEWOOD'S AND DANIELL'S PYROMETERS.

Sir,—In your Minor Correspondence, No. 251, you observe, in reference to Wedgewood's Pyrometer, and to what is said of it in the Treatise on Heat, published by the Society for the Diffusion of Useful Knowledge, that "it takes for its criterion the degree of contraction

which pure clay undergoes when exposed to heat; but it so happens that clay, subjected to an intense heat for a short time, contracts nearly as much as clay subjected to a lesser heat for a longer period." Had you read, Sir, the subsequent Treatise issued by the same Society on "The Thermometer and Pyrometer," you would have seen the above objection thus satisfactorily disposed of:—"A more formidable objection was started by some foreign chemists to Wedgewood's scale; one, indeed, that would have overturned the theory of the instrument. It was alleged, that the effect of a long continued, or often repeated, exposure to even *inferior degrees of heat*, would cause contraction of the clay, after it had undergone the action of a higher temperature. This point has been examined with much care by Guyton de Morveau, who has shown in his valuable Essay the inaccuracy of this opinion."—(Annales de Chimie, vol. lxxiv. 78—90.)

I am, Sir,
Yours, &c.
THERMOS.

We readily confess that we had not read the Treatise on "The Thermometer and Pyrometer," referred to by our correspondent, when we offered the observation on which he animadverts; but we had at the time a perfect recollection of what Guyton de Morveau had written on the subject. The author of the Treatise affirms, that Guyton de Morveau "*has shown* in his valuable Essay the inaccuracy of this opinion." This is mere assertion, and not supported by a single proof. Most other writers on heat have pronounced the French chemist's "valuable Essay" to be a palpable failure. Indeed, if the reader will only reflect for a moment on the point which Guyton de Morveau attempted to establish, he will wonder that any one should have sought to prove a thing so much at variance with the reason of the case. It was to this effect:—that clay, subjected for *one* hour to a heat of 100°, will contract to a degree that you cannot equal or approach by subjecting it to half that heat, for *two, four, eight, sixteen*, or any greater number of hours. The author of the Treatise has himself, in a previous part of his production, laid down the law of contractability in terms which wholly exclude the possibility of such a result. "It was found," he says, (page 27), "after repeated trials, that the pieces of clay *contracted* MORE AND MORE *in an uniform ratio* to the *degree of heat communicated to them, and permanently retained this contraction*." Nothing, indeed, is here said as to *the time* during which "the degree of heat" is applied; but to put that out of the consideration in such a case, would be as absurd as to affirm that "the more water you pour into a cistern the fuller it will become, but that if you take double the time to pour the water in, you will never fill the cistern at all" !!!

It is the less necessary, however, to argue about the theory of the thing, since the treatise writer admits that the results obtained by Wedgewood's pyrometer have been such as to deprive it entirely of the confidence of the philosophic world. For example;—according to Mr. Wedgewood's Tables of Temperature,

Silver melts at 4717° Fahr.
Copper ...... 4587°
Gold .... 5237°

while, according to the more accurate experiments of Mr. Daniell's,

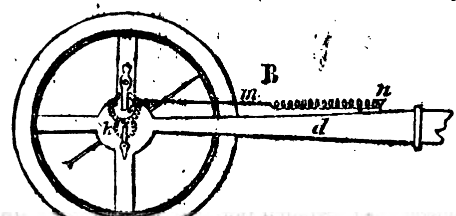
Silver melts at 2233° Fahr.
Copper ...... 2548°
Gold .... 2590°

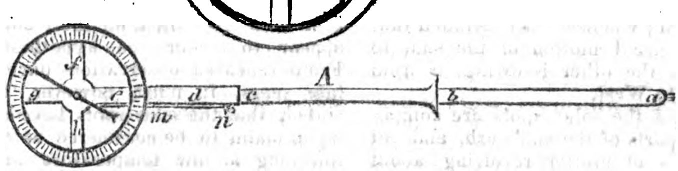
The error amounting to about a full half in each case!

We take this opportunity of subjoining an account (extracted from the Treatise of the Society, referred to by our correspondent) of the pyrometer of Mr. Daniell, from which our readers will see how well warranted is the superiority which we ascribed to it. The principle of this instrument is the *expansibility* of metals by heat.

"The pyrometer of Mr. Daniell" (see figs. A and B) "was first described in 'Brande's Quarterly Journal' (vol. xi. page 309). The moving power is a rod, or wire;

of platina (as the least fusible of metals), 10.2 inches in length, and 0.14 inch in diameter, fixed in a tube of black lead ware *a b e*, by a flanch within, and a nut and screw without, the tube at *a*. This tube has a shoulder moulded on it at *b*, for the convenience of always inserting it into the furnace or muffle, to the same depth. From the extremity of the platina rod at *b*, proceeds a fine wire of the same metal, 1-100th inch in diameter, which comes out of a brass ferrule *d*, and passes two or three times round the axis of the wheel *i*, fig. B. It then bends back, and is attached to a slender spring *m n*, which is fixed by one end to the pin at *n*, on the outside of the ferrule. The substitution of a silk string for that part of the platina wire lapped round the



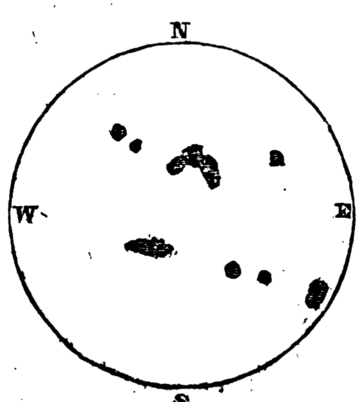


wheel, and connecting it with the spring, has rendered the motions of the index more sensible. The axis of *i* is = 0·062 inch, and the diameter of the wheel one inch; its teeth play in the teeth of another wheel just one-third of its diameter; by which the wheel *k* has three times the movement of *i*, and the index on the axis of *k* moves, therefore, three times round for every revolution of *i*. The action of the spiral spring *m* draws round the wheel *i* and the index, when the expansion of the platina rod permits it to act. The dial is divided into 360 degrees. By experiment, Daniell ascertained that each degree of his scale is = 2 degrees of Fahrenheit."

THE SOLAR SPOTS.

"The spots traversing the disc at the present time (24th June, noon) are in four distinct clustres; that to the north of the sun's centre, in the form of a crescent, consisting of nine, of unequal magnitudes, and evidently connected with one another: the largest spot is near the western limb, and is of an oval form; its nucleus is very dark and well defined. The cluster approaching the centre seems to be in great confusion, and has changed its form considerably during a few hours; other solitary spots are scattered over the disc; the whole that are distinct, with a telescopic power of 180, being about twenty-five."—*Lit. Gazette.*

For the following illustrative sketch of the appearance of the solar disc, on Tuesday, noon, 24th June, we are indebted to the same Journal.

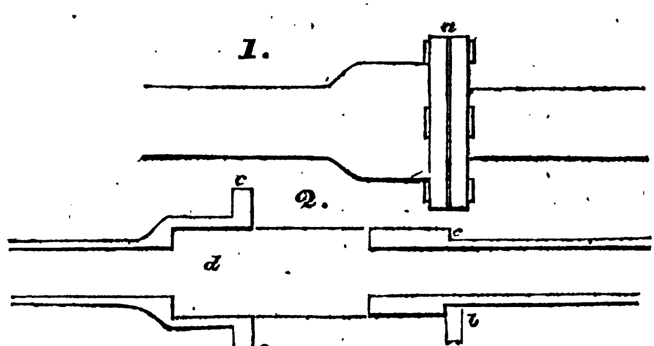


The discovery of the existence of spots in the sun was made nearly about the same time (1610) by Galileo, Harriot, and Scheiner. By means of these it was first clearly established, that the sun has a rotation round his own axis, like that of the earth, by which our natural day is measured, but only slower. For some of these spots have made their first appearance near the edge or margin of the sun, whence they have seemed gradually to pass over the sun's surface to the opposite edge, and then go out of sight for about 14 days, when they have reappeared in their first place, and have taken the same course over again, finishing their entire circuit in 27d. 12h. 20m. The motion of the spots is from West to East; whence it is concluded that the diurnal motion of the sun, to which the other is owing, is from East to West.

That the solar spots are component parts of the sun's orb, and not masses of matter revolving about him, is inferred not only from the regularity of their revolution, but from their always preserving the same relative position to each other.

"From the mystery," observes the writer in the Literary Gazette, "attending *the cause* of this phenomenon, little has been done towards its explanation beyond recording the circumstances which are found uniformly to prevail during their appearance. As to connecting them with any meteorological phenomena on our earth, there does not seem to be sufficient ground for the hypothesis. Eminent astronomers have supposed, that when these spots appear copiously, they indicate the approach of warm seasons, and the consequent luxuriance of vegetation: and this opinion it has been attempted to maintain by a comparison of years in which the spots have been most frequent, and the table of the price of wheat in Smith's 'Wealth of Nations;' and results have been obtained which, on the whole, appear to favour the hypothesis. From repeated observations during late years, it must, however, be stated, that the solar spots have an equal claim to be considered as influencing a low temperature and great humidity, as some of the largest and most numerous at one time have been observed during the prevalence of a cold and damp state of the atmosphere."

IMPROVED STEAM PIPE JOINT.



Sir,—Should the accompanying rough sketches of a joint for steam or hot water pipes be considered an improvement or remedy against the escape of steam, water, &c. it is at your service.

I am, Sir
Yours, &c.

Fig. 1 is a view of the pipes connected at the joint *a*.

Fig. 2 is a section of the internal parts.

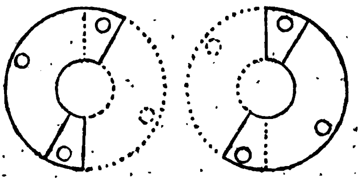


Fig. 3 are two semicircular flanges to place on the pipe at *b*, fig. 2, when in its place *d*. The shoulder *e* will be in a line with flange *c e*. When the joint is well caulked with hemp and white paint, place the semi flanges on at *b*, and screw and bolt them together as at *a*, fig. 1.

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(*Continued from page* 393.*)

43. It is now time to give some account of the notation which is used in the Differential System, and to express the difference and differential in algebraic language. And here we shall have to repeat, nearly in the same terms, the operation for the finding of fluxions, using only on the left hand side of the equations, infinitely small instead of finite quantities.

Thus, suppose u to be any quantity depending on some variable quantity x, or, as it is called, suppose u to be a function of x; and, first, let it be such a function that $u=x^2$.

Now, let x receive an increment h, and let u become u_1 in consequence.

Then $u_1=\overline{x+h}^2=x^2+2\,x\,h+h^2$.

But $u=x^2$.

$\therefore u_1-u$, or the *difference* $=2\,x\,h+h^2$.

Hence, $\frac{u_1-u}{h}=2\,x+h$.

Now, suppose h to diminish continually, and at last to become infinitely small or evanescent, then the equation becomes $\frac{u_1-u}{h}=2\,x$, the terms u_1-u, and h, being both evanescent. In the differential calculus, this value of u_1-u is called $d\,u$, and the corresponding symbol $d\,x$ is put for h. Hence the equation becomes $\frac{d\,u}{d\,x}=2\,x$. Similarly, if $u=x^3$, $\frac{d\,u}{d\,x}=3\,x^2$, and if $u=x^n$, $\frac{d\,u}{d\,x}=n.\,x^{n-1}$.

44. These quantities, $\frac{d\,u}{d\,x}$, are called differential co-efficients, and are themselves finite; but if we multiply both sides by $d\,x$, we have the equations $d\,u=2\,x.\,d\,x$, or $d\,u=3\,x^2.\,d\,x$, in which both sides are absolutely nothing; whereas the fluxional equations,

---

* The following note should have been subjoined to our last preceding paragraph;—

That quantities of the form $\frac{0}{0}$ are not mere nullities, appears from the consideration of the fraction $\frac{x^5-1}{x-1}$, by the following operation:—

$$
\begin{array}{l}
x-1)\,x^5-1\,(x^4+x^3+x^2+x+1 \\
\quad\;\; \underline{x^5-x^4} \\
\quad\quad\;\; x^4-1 \\
\quad\quad\;\; \underline{x^4-x^3} \\
\quad\quad\quad\; +x^3-1 \\
\quad\quad\quad\; \underline{+x^3-x^2} \\
\quad\quad\quad\quad\; +x^2-1 \\
\quad\quad\quad\quad\; \underline{+x^2-x} \\
\quad\quad\quad\quad\quad\; +x-1.
\end{array}
$$

We find that

$$\frac{x^5-1}{x-1}=x^4+x^3+x^2+x+1.$$

Now suppose $x=1$,

Then $x^4+x^3+x^2+x+1=5$;

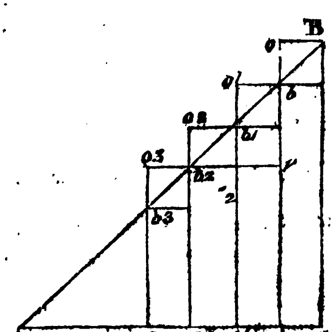
and $\frac{x^5-1}{x-1}=\frac{1-1}{1-1}=\frac{0}{0}$.

Therefore, $\frac{0}{0}=1+1+1+1+1=5$ in this case.

$u'=2.\ x.\ x',\ u'=3\ x^2.\ x'$
are equations between finite quantities.

This circumstance does not prevent us from using the equation $d\ u = 2\ x.\ d\ x$, when necessary or convenient; it is even more handy than the fluxional equation, on account of the number of dots which embarrass us when we come to the higher orders of fluxions; of which it is now time to make mention. And here we shall most sensibly feel the difficulty arising from the use of evanescent instead of finite quantities.

45. Since a fluxion is a finite quantity, and represents the velocity with which a figure increases or decreases at any point, this fluxion must itself be subject to variation; and the velocity with which it thus varies will, according to our definition, be the fluxion of the first-mentioned fluxion, or the second fluxion of the original fluent. This second fluxion also may in one case be depicted.

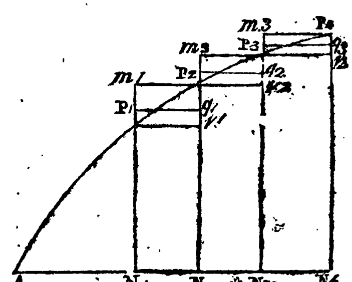


Suppose A C B to be a triangle whose area is generated by the motion of the line B C along A C, varying as it moves; then if $C_3\ C_2,\ C,\ C_1$, &c. are equal portions of A C^3 or represent the fluxion of the axis A C, by completing the parallelogram $b_3\ c_2,\ b_2\ c_1$, &c., we have the fluxions of the area at the points C_3, C_2, &c. respectively. Now, producing $C_2\ b_2$ to meet $b_1\ o_2$, which is parallel to A C in o_2, and drawing $r\ s$ parallel to A C, $r\ b_1$, which is equal to the parallelogram o^2, represents the increment of the fluxion through $C_2\ C_1$.

Similarly, the parallelograms o_1, and o, represent the increments of the fluxions through c_1 C and C: Now all these increments are evidently equal to each other; and hence, since these admit of equal increments in equal times, they increase uniformly, and their fluxions and increments are the same, and we have the parallelograms o_3, o_2, &c., for the fluxions of the parallelograms b_3, o_2, b_2, c_1, and which are the fluxions of the triangle itself; and these are called the second fluxions of the triangle.

Here the fluxion of the fluxion of the triangle, or the second fluxion of the triangle itself, is the same at every point, and appears, therefore, to be a constant quantity; whence we perceive that it cannot itself have a fluxion, and that the triangle does not admit of one of a higher order than the second.

46. But now let us again have recourse to a curvilinear area.



Divide the abscissa into a number of equal parts, $N_1\ N_2$, $N^2\ N_3$, $N^3\ N_4$, and complete the parallelograms $P_1\ N_2$, $P_2\ N_3$, $P_2\ N_4$, &c.; also draw $P_2\ m_1$ parallel to N A, meeting $N_1\ P_1$ produced in m_1; and in a similar manner complete the parallelograms $m_2\ r_2$, $m_3\ r_3$, &c. Then, according to our definition, $P_1\ N_2$, $P_2\ N_3$, $P_3\ N_4$, &c. are respectively the fluxions of the curvilinear area at the points N_1, N_2, N_3, N_4, &c.

But the rectangle $P_2\ N_3$, or its equal, $m_1\ N_2$, is evidently greater by the rectangle $m_1\ r_1$; and therefore $m_1\ r_1$ is the increment of the fluxion

$P_1 N_2$, in the time represented by $N_1 N_2$. Similarly, $m_2 r_2$, $m_3 r_3$ are the respective increments of the fluxions in the times $N_1 N_2$, $N_2 N_3$, $N_3 N_4$, &c.

These quantities are not, as in the last example, respectively equal to each other. The fluxions do not here increase uniformly; and, consequently, they cannot be represented by their increments, as before. We must take $P_1 q_1$, $P_2 q_2$, &c. equal to the increments which would be generated in the same time as the increments $m_1 r_1$, $m_1 r^2$, &c. with the velocity with which they began to be described continued uniform; and these will represent the second fluxions of the curvilinear area. But if these magnitudes, $P_1 q_1$, $P_2 q_2$, are not equal to each other, it is evident that they must have been subject to a variation, and thus that the magnitude $P_1 q_1$, $P_2 q_2$, or the second fluxion of the area, must itself admit of a fluxion likewise, or the area itself of a third fluxion, and so on, till we come, if at all, to a constant quantity.

47. To consider this analytically, suppose $u = x^5$; then $\dot{u} = 5\, x^4\, \dot{x}$. Here $\dot{u}$ is evidently a variable quantity, from the circumstance of the quantity to which it is equal containing the variable (x); it will, therefore, itself admit of a fluxion.

Let us call this $\ddot{u}$; then, since $\dot{x}$ is constant (page 89), we have, by our rule (page 324),

$$\ddot{u} = 4 \times 5.\ x^3\, \dot{x} \times \dot{x} = 4.\ 5.\ x^3\, (\dot{x})^2$$

Similarly,

$$\dddot{u} = 3.\ 4.\ 5.\ x^2.\ (\dot{x})^3$$

$$\ddddot{u} = 2.\ 3.\ 4.\ 5.\ x.\ (\dot{x})^4$$

$$\overset{\cdot\cdot\cdot\cdot\cdot}{u} = 1.\ 2.\ 3.\ 4.\ 5.\ (\dot{x})^5;$$

or, dividing these equations by the powers of $(\dot{x})$, we have

$$\frac{\dot{u}}{\dot{x}} = 5.\ x^4$$

$$\frac{\ddot{u}}{(\dot{x})^2} = 4.\ 5.\ x^3$$

$$\frac{\dddot{u}}{(\dot{x})^3} = 3.\ 4.\ 5.\ x^2$$

$$\frac{\ddddot{u}}{(\dot{x})^4} = 2.\ 3.\ 4.\ 5.\ x$$

$$\frac{\overset{\cdot\cdot\cdot\cdot\cdot}{u}}{(\dot{x})^5} = 1.\ 2.\ 3.\ 4.\ 5.$$

In the differential method, these first, second, third, &c. differentials are more neatly denoted, but are not, perhaps, so easily comprehended. The operation which we have just performed in the differential language, is expressed thus:—

Suppose $u = x^5$; then

$d\,u = 5\,x^4\,d\,x$ and $\frac{d\,u}{d\,x} = 5\,x^4$

$d^2 u = 4.\ 5.\ x^3\,(d\,x)^2$, and $\frac{d^2 u}{d\,x^2} = 4.\ 5.\ x^3$

$\frac{d^3 u}{d\,x^3} = 3.\ 4.\ 5.\ x^2\,(d\,x)^3$, and $\frac{d^3 u}{d\,x^3} = 3.\ 4.\ 5.\ x^2$

$\frac{d^4 u}{d\,x^4} = 2.3.4.5.x.\ \overline{d\,x}|^4$, and $\frac{d^4 u}{d\,x^4} = 2.\ 3.\ 4.\ 5.\ x$

$\frac{d^5 u}{d\,x^5} = 1.\ 2.\ 3.\ 4.\ 5.\ \overline{d\,x}|^5$, and $\frac{d^5 u}{d\,x^5} = 1.\ 2.\ 3.\ 4.\ 5.$

We must at once see how much more easy and simple this notation is, and how much less liable to error. Suppose, instead of putting $u = x^5$, we make it $= x^n$, which quantity admits of n fluxions, of n orders, in the fluxional expression, we must in some way modify the notation; while in the differential it is at once expressed by $\frac{d^n u^n}{d\,x^n} = 1.\ 2.\ 3.\ \ldots\ n.$

These quantities, $\frac{d\,u}{d\,x}$, $\frac{d^2 u}{d\,x^2}$, $\frac{d^3 n}{d\,x^3}$ . . ., $\frac{d_n u}{d\,x^n}$, are called the first, second, third, and nth differential co-efficients, and are themselves finite quantities of exactly the same value as $\frac{\dot{u}}{\dot{x}}$, $\frac{\ddot{u}}{(\dot{x})^2}$, $\frac{\dddot{u}}{(\dot{x})^3}$, &c.; but when we consider the terms of which they are composed, which are not only infinitely small, but are such that

each preceding differential is, though itself infinitely small, still infinitely greater than that which succeeds, we shall, it is to be feared, be rather puzzled to comprehend them. For this reason, perhaps, the method of fluxions is best adapted to the capacity of a beginner.

(*To be concluded in our next.*)

NEW PUBLICATIONS

Connected with the Arts and Sciences.

On Life Assurances, and the Diminution of Sickness, and Mortality. 40 pp. 8vo.

We have been much interested by the perusal of an essay under the above title, which appeared in a recent number of the "Westminster Review," and has since been printed in a separate form; and as the matter of it concerns the welfare of the industrious, more than any other classes of society, we propose to make some extracts from it for their information and benefit; and with the hope that these specimens may induce not a few to have recourse to the essay itself. The author has embodied in it a vast share of most curious and interesting facts, on the subject of Life Contingencies, and his deductions from them display everywhere a happy mixture of good sense, acuteness, and reflection.

The condition of the labouring classes, the writer thinks, is greatly improved at the present day, and the following are the chief grounds on which he rests this conclusion:—

"It must be admitted, that the reduced circumstances of some classes of workmen militate against this theory, but there are very few of them who have not been sustained, and even advanced, in condition, by the more skilful use of diminished means. They have gained in knowledge, and have in the same proportion been recovered from that tyrannical controul of appetites and passions, from that propensity to seize with avidity, and to use without restraint, the means of immediate gratification, which distinguishes all ignorant people of whatever rank. The sailor, when he returns from a voyage, the ill-educated heir to an estate, when he becomes of age, and the workman, who by three days' labour obtains enough to maintain him in idleness and dissipation during the remainder of the week, are influenced by very much the same class of motives. The most decisive and gratifying proof of the improvement taking place in the habits of the labouring classes, is the increase of Benefit Societies and other institutions directed to the same end, which before the middle of the last century were scarcely known. It appears from the returns made to parliament, and cited in the Report before us, that so early as 1802, there were no fewer than nine thousand six hundred and seventy-two Friendly Societies, and that in 1815, the members of these institutions in England alone, were enumerated at nine hundred and twenty-five thousand four hundred and twenty-nine. In Scotland, the numbers in proportion to the population were still more considerable; and in both countries they have subsequently much increased. We may add, also, that during the last year, the deposits in the Savings' Banks amounted to upwards of sixteen millions of money. Of this sum a large proportion, though not probably so large as is generally supposed, consists of deposits from mechanics and other labouring men. The prosperity of these institutions is gratifying, as affording evidence that large classes of the labouring community possess surplus means beyond what are requisite to procure them the necessaries of life;—it is cheering, as indicating the growth of improved habits of foresight and self-restraint, which must exercise an important moral influence over all their actions and relations in society.

"Considerable improvements have taken place in the domestic habits of artizans; they are more cleanly and regular, their houses are better constructed, they have acquired some notion, that fresh air is conducive to health, and the streets where they reside are less filthy and pestilential than formerly. When to this enumeration of the causes of diminution in the amount of mortality, are added the extensive reductions which must be occasioned by vaccination, less injurious nursing in infancy, and improved medical treatment, enough of this species of evidence has been adduced to satisfy us, that however the condition of some classes may have been deteriorated, the sum of improvement in the entire community will be found to preponderate considerably."

Although Benefit Societies and Savings' Banks are thus allowed to have had an important influence in bringing about this state of amelioration, the plan of pampering them by the allowance of a greater than the market rate of interest is sturdily reprobated.

"We shall here advert to another source of extravagant expenditure, which has been pointed out by Mr. Hume. The commissioners for the management of the National Debt, pay four and a half per cent upon all deposits, whether received from Friendly Societies or Savings' Banks. We are ignorant of any good reason why the public should receive these deposits on other terms than those which would be settled between individual and individual, in a common mercantile transaction. Admitting to the full extent the importance of giving encouragement to economical habits, we deny that the payment of bounties is necessary for such a purpose, or that more is requisite than to extend to the parties that superior accommodation, and greater security for investment, which it is in the power of government to afford. This, we apprehend, would form an inducement adequate to every salutary purpose. All that is given as interest, beyond the market-price of money, is simply a premium upon fraud. Not long after the Savings' Banks were brought into operation, the market-interest of money being below four and a half per cent., it was found that investments were made in great numbers, by far different persons from those for whose benefit the institution was intended. Instead of reducing the rate of interest to the level of the market, and thereby taking away the motive to the commission of fraud, the legislature enacted, that no more than 200*l.* should be received from one person: that no person should make investments of monies at two or more banks, on pain of forfeiting the additional sum beyond a total of 200*l.* so invested, &c. &c. But it is only requisite to know the amount of the bounty which four and a half per cent., at the market price of money, did then, and does now, afford, to be satisfied that these enactments are constantly evaded. When these institutions make a deposit of their savings in the hands of the commissioners for the management of the National Debt, the latter purchase stock with it in the market. The present price, eighty-six and three-quarters, will yield 3*l.* 9*s.* 2*d.* per cent. interest, and as they allow the depositor interest at 4*l.* 11*s.* 2*d.* per cent., the public are losing at the rate of 1*l.* 2*s.* 1*d.* upon every hundred pounds received: they lose in addition all the expenses of management. When a depositor can thus obtain for each 100*l.* deposited, as much interest as 131*l.* 19*s.* 7*d.* laid out in stock at eighty-six and three-quarters would bring in the market, even though subject to the risk of depression, it needs excite no surprise that these deposits amount to the enormous sum of upwards of sixteen millions of money. It is notorious that, in consequence of these inducements, the legislative enactments are set at defiance by persons who, besides their own deposits, make fraudulent investments in the names of the various members of their families, their relations or their friends. Thus skilfully do our legislators attempt to cultivate good habits among one portion of the community, and succeed in promoting bad habits among another! The public are greatly indebted to Mr. Hume for having endeavoured to check this expenditure, which was, indeed, injurious to the labouring classes, by representing their surplus means as far beyond the real amount."

The author might have dwelt even more than he has done on the unfavourable effect which such a system has on the class of persons for whose special benefit these institutions were designed. Whatever has a tendency to lessen in the least, the dependence of labourers on their own exertions, and to make them objects of either bounty or charity, may be safely pronounced to be wholly injurious. Let every thing possible be done to clear the way for them; let needless obstacles be removed, and weighty burdens be diminished, if not entirely cast off; let useful plans of action be devised for them; let them, in short, be shown how they may, by the labour of their own hands and heads, and by making proper use of the opportunities which are open to them, raise themselves above want and ignorance; but let us by all means refrain from inflicting upon them pecuniary favours of any description. The allowance of a superior rate of interest on the savings of the poor, the encouragement of begging associations among them (for what else can pension associations, that depend on the donations of the rich, be called?), and the system of gratuitous lecturing and teaching, are all things of the same stamp; the fruits of a philanthropic sentimentalism, which leads persons to be over-meddling with the concerns of others, and to be forgetful of the wholesome energy which springs from a sense of depending on oneself entirely. "A clear field and fair play," are all that any able-bodied and right-minded man wants; go-carts, crutches, and alms, should be reserved for the helpless, the decrepit, and the destitute.

It has been long a great desideratum

to ascertain in what degree mortality is influenced by particular trades and avocations. The following statements of the reviewer on this head are extremely curious.

"It is only in Paris that the collection of any satisfactory information of this kind has been attempted. From the First Report (p. 169) we learn that M. Villermé made a comparison of two arrondissements of that capital; of the first arrondissement, which contains the largest proportion of wealthy people, and the twelfth, which contains the greatest proportion of poor people. The total difference is such, that when fifty people die in the first arrondissement, one hundred die in the twelfth. There is one birth annually for more than every thirty-two inhabitants of the first arrondissement, and one in twenty-six of the twelfth, and yet there are not more children from the age of 0 to 5 years in the last than in the first—a proof that the poor bring forth more children than the rich, but preserve fewer. From a paper compiled by the same gentleman from the registers of the hospitals at Paris, it is made to appear that disease is not more frequent among the poor than among the rich or middling classes, but it is more frequently fatal to the former than to the latter, and the gradation of wealth, or the means of providing comforts, may be almost taken as the scale of mortality; thus, in the higher classes of workmen, such as jewellers, printers, and compositors, who enter the hospital, one in eleven dies; whilst among the shoe-makers or brick-makers one in seven is the average mortality; of the stonemasons, one in six; of the common labourers, one in five; and of the poorest classes of all, the porters and rag merchants, one in four: amongst the soldiers, who are in more favourable circumstances, not one in twenty; a fact which corroborates an observation of Dr. Mitchell, that the lives of our soldiers are better than those of the average of artizans. Our soldiers are in general better lodged and fed than those of the French army: we may infer, therefore, that their lives are better. The baleful effects of poverty were most perceptible in the greater mortality among the aged, and the very young; a proof that poverty and bad diet, which weaken the general constitution, must be always taken into account as one of the predisposing causes of mortality."

"The best, and almost the only data we have to judge of the probable amount of sickness among the labouring classes in Great Britain, are, the returns obtained by the exertions of the Highland Society of Scotland. This Society procured returns from seventy-nine benefit societies, situate in sixteen counties of Scotland. These returns were made up from the books kept during various periods, in some instances extending from 1750 to 1821. The aggregate number of members on the books of the respective societies was 104,218. The first table ever formed to exhibit the probable annual sickness which a labouring man will sustain through life, is to be found in an able Report drawn up by Mr. Oliphant for the Society. The results stated are, that a working man will experience in a year, at

Years of Age.	Sickness.
21	4 days
46	1 week
57	2 weeks
63	3 weeks
65	4 4-10ths weeks
66	5 4-10ths weeks
67	6 5-10ths weeks
68	8 weeks
69	9 weeks
70	10 weeks

The proportion, after that period, goes on increasing rapidly, at a rate that puts the individual beyond the means of assurance possessed by any of these institutions. The Society endeavoured to ascertain, also, the different degrees of intensity to be expected in this sickness; and they state, as their nearest approximation, that, of ten weeks of sickness amongst persons of all ages under seventy, two may be assumed as bedfast sickness, five as walking, three as permanent sickness."

We have but room for one quotation more. It relates to the increase of population among the poor, and states the results which Dr. Granville, the eminent physician, has obtained on this subject from a register of 24,450 cases that have come under his observation at the Westminster Dispensary and other medical Institutions.

"For this purpose the doctor puts a multiplicity of questions, to ascertain the earliest age at which women of the poorer classes marry,—the number of children they produce in a given period, —how many of those children may be expected to die within a given period,—and of what diseases,—at what period of life married women among the labouring classes are the most prolific,—at what time they cease to bear children,—what is the influence of the occupations

of the parents on the health of the offspring,—what is the effect of locality, under the head of residence, among the poor—besides a number of other questions on medical as well as statistical points of inquiry, the answers to which he registers in the manner he has described. He submitted to the committee the registered cases of 876 women, for the truth of whose statements he possessed the most satisfactory securities; but in all other respects they were taken indifferently. The following table, derived from their answers as to the age at which they respectively married, is the first ever constructed to exhibit to females their chances of marriage at various ages. Of the 876 females there were married.

	Years of Age.		Years of Age.
3	at 13	26	at 27
11	14	22	28
16	15	17	29
43	16	9	30
46	17	7	31
76	18	6	32
115	19	7	33
118	20	6	34
86	21	2	35
85	22	0	36
59	23	2	37
53	24	0	38
36	25	1	39
24	26		

"It is to be borne in mind that the females, whose relative ages at the time of their marriage are above exhibited, were all of the lower classes. Among an equal number from the middling or the higher classes, we should not probably find so many as 195, or more than one-fifth, married under the age of 19 or so few as one-sixteenth part after 28; or only one-thirteenth part above 30. From these 876 marriages there had been, previously to the then existing pregnancies, 4,621 pregnancies; of which number 655 had miscarried; 176 were still-born; and 2,914 children were born alive. Thus there may be said to have been 3,966 births, or an average of 4½ to each marriage. Of these 1,675 children survived. He had no means of ascertaining what proportion the marriages, which were unproductive, bore to those which were productive. Mr. Malthus gives 4½ as the average number of children produced from each marriage. Dr. Granville found, that during the whole time at which these women continued to bear children, they had each two children in about four years. Considerable exertion was bestowed by the doctor to determine what effect the age at which a woman married had on the number of children she produced. He observes,

"'It is a curious fact, that if a woman marries at twenty-one or twenty-two, and is placed under precisely similar circumstances for the following fifteen years as women at fourteen, fifteen, and sixteen, marrying at that age, may be supposed to be under, will produce the same number of children as the latter would, though the party marry seven or eight years later; and the reason is this, that those who marry very young cease either sooner, or go a great number of years without children. When they arrive at twenty or twenty-five years of age, they will stop at about thirty, and begin again; whereas, the age of maturity at which a woman is most prolific appears to be about twenty; and there seems to be no stoppage, except disease steps in—going on regularly every two years, or, if she do not suckle, every year, until she arrives at forty or forty-two years of age, which is the usual period for it to terminate.'—*Second Report*, p. 42.

"He found that the permanent ordinary state of health of the father, as well as of the mother of the child, had a greater influence on its health than was commonly suspected. The witness had made greater progress in the collection than in the operation of theorizing his facts; and on several points he abstained from stating his conclusions to the committee, as he did not consider that he had yet attained the requisite degree of completeness to warrant him in promulgating them. We trust that he will persevere in his most useful and singularly meritorious labours; and we anticipate that, when they are submitted to the public, the results will be found highly important."

THAMES TUNNEL.

The last act in the history of this concern which we brought under the notice of our readers, was the obtaining of an Act of Parliament to raise 100,000*l.*, by way of loan, to complete the work. The subscription to this loan has proceeded so slowly, that recourse has been once more had to the mode of voluntary subscription. On Saturday last there was a public meeting, which was honoured by the presence of the Dukes of Cambridge, Wellington, and Somerset, the Earls of Aberdeen and Powis, &c., when resolutions were entered into, strongly declaratory of the national importance of the undertaking, and upwards of 5000*l.* were subscribed.

How long will it be before the managers of this concern are persuaded that a much shorter way than either speechifying or subscription-begging to obtain the money they want, would be to convince people that proper provision has been made against the recurrence of accidents, and that there is no fear of the sum asked (100,000*l.*) being fully adequate to the completion of the work? No one likes to invest, or even to throw away, money in the dark. A report from two or three such men as Mr. Telford, certifying that the means which the engineer of the Tunnel has provided against any mere irruptions of the river, are the best of which the nature of the case admits, and that the estimates on the strength of which it is represented that no more than 100,000*l.* additional will be required, are fair and reasonable, would have more weight than the speeches and gifts of fifty Dukes. With any less guarantee than this, indeed, the managers ought not to expect the public to be satisfied; and without it, we are convinced, the money wanted will never be obtained, either in one way or another.

THE NEW PALACE.

The author of this architectural monstrosity turns out at last to be no other than the gentleman who has been so often said to have had no hand in the matter—Mr. Nash!! He has not only pleaded guilty to the charge of planning and executing it, before a Committee of the House of Commons appointed to inquire into the proceedings of the Board of Works, but thus candidly accounts for some of its more prominent defects. What follows we quote from the Report of the Committee:—"Another larger, and much more expensive building, which is in progress for his Majesty's Palace in St. James's Park, is now undergoing very considerable alterations, not originally contemplated, for the purpose of rectifying a defect, which scarcely could have occurred if a model of the entire edifice had previously been made and duly examined. Mr. Nash says, in answer to a question relating to the two detached three-windowed houses at the extreme angles of the wings,—'I was not at first aware that the effect would have been so bad; and I am sorry to say, that I was disappointed myself in the effect of them.' The consequence of this alteration, thus occasioned, will increase the interior accommodation, by adding 27 new apartments to the present number; but it is estimated at no less a sum than 50,000*l.* With regard to the dome above the roof of the palace, Mr. Nash deems it unfortunate that it is visible from the Park side, which was not intended by him; nor was he aware that it would have been seen, except as belonging exclusively to the garden front."

The Committee seem to think that "*a model*" would have enabled Mr. Nash to foresee and avoid these *effects*. A model supply good taste and grand ideas!!!—What next?

MISCELLANEOUS NOTICES.

Colours of the Sea.—The variety of colours in the sea seem to depend chiefly on the wind, the weather, and the reflection of light from the firmament. Its most usual colour is deep green; but in cloudy, or rainy weather, and even when it is looked down upon from an elevated point of sight, it assumes a dark blackish tint. On the Goodwin Sands, at the tide of flood, the water is whitish by reason of the foam. In the Meditterranean, again, it will appear for weeks together to be of a perfect azure. When the sun shines bright upon the water, the upper portion of the waves takes of purple or reddish hues; and when the wind freshens, and a ship is under full sail, the waves a-head often appear pale and bright.

White Cats with Blue Eyes are always Deaf.—So, at least, we find it positively asserted by two correspondents of the "Magazine of Natural History," who mentions several facts in confirmation of this extraordinary coincidence.

Longevity of Tortoises.—In Lambeth Palace there is the shell of a tortoise, which was brought there alive in 1623, and lived until 1730, when it died through a careless exposure to the inclemency of the weather. Another at the Episcopal Palace at Fulham, procured by Bishop Laud, in 1628, lived till 1753; and Mr. Murray, author of "Experimental Researches in Natural History," saw one in 1819, at Peterborough, which had lived 220 years!

Fish fascinated by Music.—In Germany, the shad is taken by means of nets, to which bows of wood, hung with a number of small bells are attached in such a manner as to chime in harmony when the nets are moved. The shads, when once attracted by the sound, will not attempt to escape while the bells continue to ring. Ælian mentions that, in ancient times, the shad was allured by the sound of castanets.

INTERIM NOTICES.

Communications received from Mr. Deakin—Chapeau—G. G. Sparkes—A. B. C.—Mr. Utting—F. C.—H. Bayley—Mr. Hudson (New North-road)—A Rural Saunterer—Mr. Harrison (his first through Mr. N. not yet come to hand)—A. P. S.—and Rusticus.

Erratum in last Number.—The problem, a solution of which, by "F.," we inserted in our last Number, p. 394, was not, as erroneously stated in the heading of it, proposed by Mr. Jopling, but by "F." himself, in relation to Mr. Jopling's Septenary System.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster Row, London.

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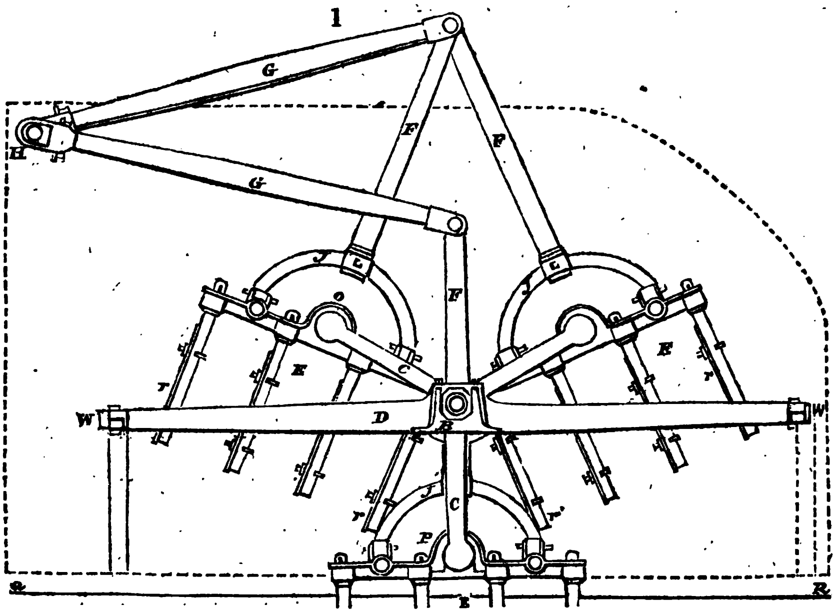
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 258.] SATURDAY, JULY 19, 1828. [Price 3d.

STEVENS'S IMPROVED PADDLES, FOR STEAMERS, CANAL BOATS, &c.

1



Among the inventions for which patents have been recently taken out, one of the most ingenious and exclusively useful appears to be that granted to Mr. John Lee Stevens, of Plymouth (an active member, if we mistake not, of the Plymouth Mechanics' Institute), for a method of propelling vessels by the agency of a series of paddles attached to a three-throw crank, with the aid of steam or other power; and which may also be used as a substitute for undershot water-wheels, &c.

Fig. 1 represents a side elevation of the machinery, as it would appear in a paddle box, when applied to the purpose of propelling. B is one of the bearings of the centre of the axis of the triple crank C C C; which bearing would be supported on the side frame of the paddle box; D is one of the longitudinal bars which support the other bearings of the axis of the triple crank; W W are transverse beams to support the ends of the bar D. The dotted lines represent the paddle box; E E E are three sets of paddles, each set being carried and worked by a division of the triple or three-throw crank, while the peculiar motion required for the paddles is given by means of the guide rods F F F, and the radius rods G G; which radius rods work on a bar or centre at H; J J J are spreaders, to keep the paddles steady, and cause them to work firmly.

By this arrangement it will be seen that one set of paddles is always acting against the water, and some-

times two sets at the same time. The parts marked *r* are the paddles, and are fixed to vertical bars by hooks and nuts, in the ordinary way; the upper ends of the bars being inserted in sockets cast in the bar *k* (see fig. 2), which is called the paddle carriage. It will of course be necessary to make a provision in the top of the paddle box to allow of the occasional rise of the bars G and F above it, when the paddles are in action.

Fig. 2 represents a plan of the apparatus; *m* is the shaft from the steam-engine, or other power, communicating motion to the triple crank. It will be seen by this figure that the paddle carriages are hung to each division of the crank by two bearings in each of the three divisions. It will also be seen that the crank has four supporting bearings, the inner of which, *s*, is fixed to the vessel's side, the outer one B is carried on the frame-work of the paddle box, and the two intermediate ones *t* and *v* on the longitudinal bars *d*, which are fixed fore and aft to the transverse beams W W, or to the frame-work of the paddle box; each division of the triple crank carries a paddle or set of paddles, which, with the carriage, works within the arms of the said division of the triple crank.

By this drawing it will be seen that the bar or beam *h* extends from the side of the vessel at one end, and is fixed to, or in, the outer frame of the paddle box at the other end. The circle of motion described by the triple crank is equally divided between each division thereof, so that they nearly balance each other on their mutual and general centre.

The chief advantages which this method promises over the common wheel are,

1st. As the inventor's paddles work in a vertical position (with sufficient allowance for the impetus of the vessel), they cause a saving of the power now consumed by the *de*scending and *as*cending paddles, and produce an increased application of power.*

2d. The avoidance of unpleasant vibration, and consequent wear and tear in the vessel and engines; and also of the run of backwater, which is so very dangerous to wherries, &c. and has, hitherto, been the means of preventing the introduction of steamers upon canals.

3d. The capability of increased velocity, commensurate with the power applied,—Mr. S.'s paddles not being subject to the maximum of motion that limits the revolutions of the common wheel.

4th. Equal applicability in propelling vessels ahead or astern.

5th. The machinery being easily taken to pieces, and packed in a much less space than would be required for a wheel, additional sets may be conveniently taken on long voyages.

* The following comparative statement of the application of power between a common wheel, whose paddles are 7½ feet long and 1½ foot deep, and the inventor's paddles, fitted in the same space from the vessel's side, will show more clearly the advantages gained under this head.

Common Wheel.	Ft.	In.
A paddle 7 ft. 6 in. long, and 1 ft. 6 in. deep, gives a square surface of	11	2
Say there are always *two* immersed	—	2
	22	6
Deduct 1-3d, the quoted allowance for loss of power on the *de*scending and *as*cending paddles	7	6
Leaving	15	0

Mr. Stevens's Paddles.	
Taking them at 2 ft. wide and 2½ ft. deep, each presents a surface of	5 feet
He has always *four* paddles immersed	4
	20
And as each set, of four paddles, describes the segment of an ellipse, in the water, instead of that of a circle, he considers himself within bounds in claiming 1-5th part	4
Giving	24

Showing a very considerable advantage in favour of the invention, besides the capability of increased velocity.

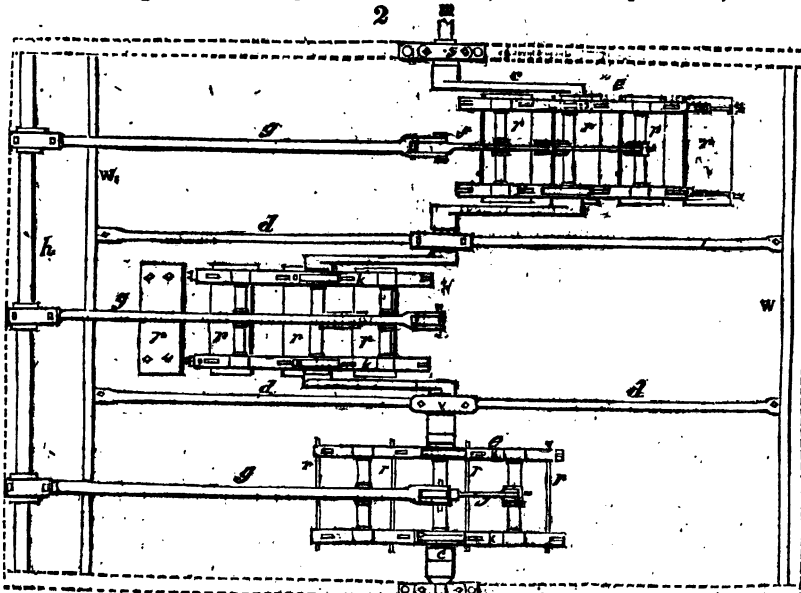
6th. An accident occurring to one set (or even two out of three on either side) would not prevent the working of the remainder.

Mr. Stevens thinks that, in many instances, the application of this invention to vessels already fitted with steam-engines, will increase their velocity more than one-third; while for new vessels, engines of about 40 horse power will equal the work now performed by those of 60, thereby causing less draught of water, greater despatch, affording more stowage for goods, and better accommodation for passengers. But as a trifling increase of speed will produce an immense annual saving of fuel, Mr. S. contents himself with stating the average as follows:—

A steamer of 100 horse power consumes about 16 bushs. of coals per hour, which, for *twelve* hours, at 1*s*. 3*d*. per bush. will cost....	£ 12
Take her average speed at 8 miles per hour, and supposing Mr. S.'s paddles to increase that speed *only a fourth*, she will perform the same distance in 9 hours, at a cost of	9
And save................	£ 3

Supposing the average of her work to be but 48 hours per week, she would save in that time £12; or £624 per annum upon *fuel* alone.

2



Mr. Stevens has been favoured with a letter on the subject of his invention, from the celebrated navigator Capt. John Ross, K. S. R. N., author of a Treatise on Navigation by Steam, &c., which we have great pleasure in subjoining to this account.

"160, *New Bond-st., London, June* 18, 1828.

"Sir,—Having minutely examined the model explaining your new method of propelling steam vessels, for which you have obtained a patent; having considered the principles of your invention, and the advantages obtained by it;—I have no hesitation in declaring, that it appears to possess a very considerable superiority over all the methods which have hitherto been adopted. In theory, it is perfectly accordant with philosophical and mechanical laws; and I have no doubt that, in practice, it will be found no less consistent. In short, it is, in my opinion, an ingenious and valuable invention, which,

after a few trials to establish its just and relative proportions, will be generally adopted, and will probably prove both lucrative to those who are concerned in it, and beneficial to the public.

"I am, Sir, yours, &c.
"JOHN ROSS,
"*Capt. of the R. N.*"

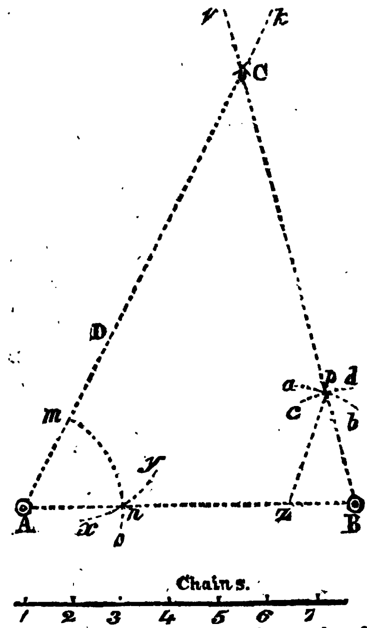
To Mr. J. L. Stevens,
19, *Essex-street, Strand.*

ON THE MEASUREMENT OF DISTANCES.

BY MR. H. FOORD, LAND-SURVEYOR, SANDWICH.

Sir,—In the "Mechanics' Magazine" for October, 1827, there is a method set forth by Mr. Shires, to find the angle of subtend between two objects; but he has omitted the trigonometrical calculations requisite to find the respective distances. The following is proposed, as a method to find the distance of an object from any assumed stations, when the angles of observation are not known. It may, perhaps, be of use to such as are not acquainted with the rules of trigonometry.

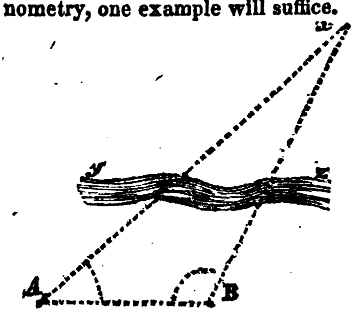
By Gunter's Chain.—Suppose it is required to find the distance of an object, as seen from any point A,—as C, a mill or tree. Measure out any distance A B, for a base line,—say seven chains. From station A set up a stick at any convenient distance, as D, in the direction of the object C, and make A m=A n on the base. Also from station B set up another stick in the line of direction to C, as at P. Set off any distance from B, as at Z; this done, proceed to measure the distant marks. At A, distance A m=A n =n m=220 links; at B, distance B Z=150, B p=252, and Z p=270. These particulars being found to construct the figure. On A, with distance A m in the opening of the compasses, sweep the curve m o. On m, with distance n m, mark x y; the intersection is at n, on the line of the base. On B, with distance B p, draw c d, and with Z p draw a b; the intersection of these lines is at p. Then from A, through m, draw m C k; and from B, through the point of intersection at p, draw B C v; and the figure is duly con-



structed. The lines in the angle of meeting mark the place of the object; which being measured by the scale of the base, gives the distance A C=1170, B C=974 links; which, by reduction, make A C=46¾ rods, and B C=39 rods.

Note.—In taking the requisite measures in the field, the parts of a link should be regarded, especially when the distances required are short. In this manner the distance of two or more objects may easily be obtained.

To those who understand trigonometry, one example will suffice.



A house x, situate on the opposite side of a river $y\ z$.

To find the distance from two stations.

Base line A and B, $11\frac{1}{2}$ chains asunder, and angles of observation as follow:—

At A, B x forms an angle of . . . . $41°\ 42'$
At B, A x ditto. 118 24

From this statement it is required to find the distance from each station to the mansion at x.

Calculation.. 118 24
+ 41 42
——— then $180° - 160°\ 06' = 19°\ 54$
Sum......= 160 06

the angle of A B seen from x. Then, to find the distance A C,

	Co. Ar. Log.
$\angle x = 19°\ 54'$......	$= 0{\cdot}468037$
to the base $11\frac{1}{2}$	$= 1{\cdot}060698$
$\angle$ B $118°\ 24'$ suppt. $= 61°\ 36'$	$= 9{\cdot}944309$
Line A x = 29 72 chains..........	$= 1{\cdot}473044 = 118\frac{3}{4}$ rods.

		Co. Ar. Log.
For the distance B x .. $\angle x$ ..	$= 19°\ 54'$	$= 0{\cdot}468037$
Base $11\frac{1}{2}$ ..	$= 11{\cdot}5$	$= 1{\cdot}060698$
$\angle$ A ..	$= 41°\ 42'$	$= 9{\cdot}822972$
$\therefore$ B x ..	$= 22{\cdot}48$ chains..	$= 1{\cdot}351707 = 89$ rods.

In the "Mechanics' Magazine" I find a remark, signed "R. H.," concerning the finding of distances from *one* station, to the effect that this is impracticable. In "Boys's History of Sandwich," and among the Biographical Notices of the town clerks of that port, it is said of a Mr. Robert Jager, that "he published a small 8vo. volume of Artificial Arithmetic in Decimals, showing the original ground and foundation thereof; with the quintessence of the Golden Rule, the true valuation of annuities, and solutions of all difficult questions of that nature." Also, how to "find a distance *at one station*,—an art never till of late invented, and not till now published; together with diverse (divers) uses and applications thereof, very useful and necessary for gunners, seamen, and surveyors of land." This gentleman entered on his clerkship in 1640, and died in 1654, and was buried at St. Mary's, Sandwich. If the valuable fragment of science above alluded to could be found at this time, the particulars contained therein might be of use.

H. F.

REPLY TO VECTIS, ON THE DIFFERENCE OF LONGITUDE IN TIME.

BY MR. J. UTTING.

Sir,—On receiving your Magazine of June 26, I was much surprised at seeing a communication on the Difference of Longitude in Time, by "Vectis," as I had presumed that the controversy was terminated. I must, however, beg your permission to insert a few remarks, as "Vectis" says that *I have again missed the principles of the subject altogether!* I shall at least, I trust, be able to prove that he has not altogether hit them. In respect to his *Examples*, I unfortunately have not got the "Nautical Almanac for 1827." I shall, however, substitute an Example for the same day of the year 1826, viz. 20th of February, in order to show the errors in the Examples of "Vectis."

	h.	m.	s.
1826, Feb. 20, mean noon at Greenwich, or mean time, Feb. 19	24	0	0·00
Equation of time for apparent noon, 20th	—0	14	5·30
Proportional part of daily variation for 14′ 5·3″..........	—0	0	0·07
Apparent time at Greenwich	23	45	54·63
Sun's right ascension, 19th Feb.........	22	9	49·70
Proportion of daily variation for 23 h. 45 m. 54·63 s.	0	3	47·95
Sidereal time at Greenwich	=21	59	32·28
Mean noon at P, 120° W.Lon., Feb. 20..	8	0	0·00
Equation of time, mean noon at P......14′ 5·37″ Var. for 8 h.— 2·33	—0	14	3·04
Apparent time at P..	7	45	56·96
Sun's right ascension, Feb. 20	22	13	39·90
Proportional part for 7 h. 45 m. 56·96 s...	0	1	14·26
Sidereal time at P, 120° W.	=30	0	51·12
Sidereal time at Greenwich	21	59	32·28
Difference in sidereal time............	=8	1	18·84
Apparent time at P..	7	45	56·96
Ditto at Greenwich ..	23	45	54·63
Difference of apparent time	8	0	2·33
Hence, the difference in mean time is ..	8	0	0
Ditto apparent time..	8	0	2·33
Ditto sidereal time ..	8	1	18·84

The excess of apparent time above 8 hours is 2⅓ seconds, which is equal to one-third of the daily variation. The excess of sidereal time is equivalent to 1′ 18·84″, which is equal to the acceleration of the fixed stars for 8 hours, which may be found by the Tables for converting mean solar into sidereal time. (See Dr. Pearson's "Introduction to Practical Astronomy," vol. i. p. 110.)

"Vectis" makes the equation of time at both places the same; that for Greenwich he states at —14′ 6″, and for apparent noon at P,—14′ 10″ + 0′ 4″ = — 14′ 6″ also.

It is, however, evident that there must be a variation of 2 seconds in a period of 8 hours, for a meridian either east or west of Greenwich, as the daily variation in the example given by "Vectis" is 6 seconds.

In finding the *sidereal time* at P, in the first Example, the sun's right ascension is incorrectly applied, as well as that of *the equation of time;* so that the whole of the examples of "Vectis" are vitiated: these are additional mistakes, for which, perhaps, "*Vectis*" *cannot easily account!!* The fact is, that he has, by an erroneous method, *unconsciously* reduced the *three* denominations of time to that of *mean time,* in every one of his Examples. In his first Example, he makes the *three* species of time *precisely* equal to 8 hours; in his second Example, equal to 6 hours; and in his third, equal to 4 hours precisely;—all of which are in mean time only!

I cannot view the Examples of "Vectis" without admiration; he displays great ingenuity in bringing out his results so perfectly in accordance. *Mean, apparent,* and *sidereal* time are *the same in all cases!* Surely that man must have been a blockhead that first introduced these different species of time, when *one* denomination of time would answer the same purpose!

I am, however, fearful that the same difficulty in calculation must still remain. No one besides "Vectis" will, I presume, contend that eight hours of *apparent, mean,* or *sidereal* time are precisely equal to each other. I have already shown (in vol. ix. p. 188), by data taken from the "Nautical Almanac for 1826," that the length of the apparent day was 24 h. 0 m. 30 s. of mean solar time, which is equal to 24 h.

4 m. 28·6 s. of sidereal time. How can "Vectis" reconcile this? The sidereal day is to that of the solar, as 0·997269672 to unity, or as 23 h. 56 m. 4·09967473 s. to 24 hours of mean solar time.

Mean time is measured by the mean diurnal motion of the earth, in reference to the sun; *sidereal time*, in reference to a fixed star; but *apparent time* cannot be so measured, unless the intervals of time between the daily transits of the sun over the same meridian were divided, in all cases, into 24 parts, or *apparent hours!* Of course the clocks would not go two days alike.

When time-keepers are used, the *apparent time* deduced from an altitude of the sun must be corrected by the *equation of time*, and the *mean time* found compared by that shown by the watch. The difference will be the longitude in time from the meridian by which the watch was set. (See "Nautical Almanac," p. 166.)

I remain, Sir,
Yours truly,
J. UTTING.

Lynn Regis, July 1, 1828.

P. S.—In respect to the longitudes found from the *lunar distances*, the greatest error that can possibly happen for 180° of longitude east or west of Greenwich, about the 24th of December, will amount to less than 4 miles in the distance; and many places whose longitudes are given in the "Nautical Almanac," have been found to exceed even this difference.

N. B. By Dr. Brinkley's computations ("Vince's Astron.," vol. i. p. 535, second edition), Longitude of Obser. Trin. Coll., Dublin, =25 m. 22 s. west of Greenwich. Ditto, from another calculation, p. 547, =25 m. 24·9 s. ditto. The difference here is 2·9 s.,—nearly equal to a distance of 3-4ths of a mile.

J. U.

MESSRS. VAUGHAN AND CO.'S STEAM-ENGINE.

Sir,—Being desirous of seeing justice done both to the manufacturers and the purchasers of steam-engines, I am induced to offer some observations respecting the statement of Messrs. Vaughan, in No. 256, as they have claimed for their engine a merit which I think it may be easily shown does not belong to it.

The principal advantage claimed for their engine is, that it works with the pressure of the atmosphere in its favour, and which is about fifteen pounds per inch,—an advantage which, if it did possess, would be indeed immense, and not difficult to be established,—but which it requires only a few simple arithmetical calculations to prove that it has not.

Suppose a cylinder and piston, with an area of 100 inches, upon Watt's principle; that the piston has arrived at the bottom, and the communication between the upper part of the cylinder and the condenser is opened, and a vacuum produced, and steam of 10 pounds pressure on the inch is admitted under the piston; the piston will be driven upwards by a force of 1000 pounds.

Suppose also a cylinder and pistons of equal dimensions, upon the plan of Messrs. V.; also that they have descended, that a vacuum is formed between the lower one and the partition, and that steam of the same power as in the former case is admitted underneath the upper one;—there are here three pressures to take into the account; namely,

1. The pressure of the steam on the lower surface of the upper piston, and which is upwards, 100 × 10 is	1000	pounds
2. The pressure of the atmosphere on the lower surface of the lower piston, which is also upwards, allowing 15 lbs. to the inch, 100 × 15 is....	1500	do.
Total amount of the pressure upwards	500	
3. The pressure of the atmosphere on the upper surface of the upper piston, which is downwards, and which, being deducted from the total		

amount, the remainder will show the force with which the piston is driven upwards,
as before, 100×15 is 1500 do.

1000

The pistons then, in this case, are driven upwards by a force of 1000 lbs.: where, then, can be any advantage over those upon the principle of Watt? The pistons would, in each case, act with the same force if there were no atmosphere in existence.

Suppose again, a cylinder and piston of 100 inches area upon each construction, in the same situation as before, and that steam is admitted with a pressure of 4 pounds on the inch; according to the principles Messrs. V. have endeavoured to establish, the piston on Watt's construction would be raised by a force of 400 lbs., whilst theirs, having the additional force of the atmosphere, would be raised by a force of 1500 lbs. more, or 1900 lbs. altogether. Or, supposing the steam to be only one pound pressure to the inch, Watt's would be raised by a force of 100 lbs., and theirs, if the pressure of the atmosphere is to be added, would be raised by a force of 1600 lbs., thus doing 16 times the work with the same expense of steam; and a claim to such a superiority may possibly "have had its effect in encouraging incredulity." Perhaps, also, "some persons, calling themselves engineers," may not have been very ignorant, in asserting that the atmosphere acts against as well as for them.

That one particular engine of Messrs. V.'s construction, of the same size with one of Watt's, should be able to do nearly double the work, with steam of more than double the pressure, by no means proves the point which they have attempted to prove. Let steam of equal pressure be admitted into each of those cylinders mentioned p. 387; then, if Messrs. V.'s claims are just, their pistons will raise 10,590 pounds more than the other,—that being the amount of the pressure of the atmosphere upon that surface.

The cylinder of Messrs. V. being open at both ends, and being, in some degree, cooled at every stroke, thereby condenses, in some measure, the steam admitted into it,—a circumstance which it is rather singular should be mentioned as one of its advantages.

I am, &c.
J. BARNARD.

Harlow, July 11, 1828.

[Communications on the same subject have been subsequently received from Mr. Farley—Honestus—and Trebor Valentine; they shall receive due attention.—EDIT.]

CHEAP AND SIMPLE MODE OF RAISING WATER IN HOUSES.

Sir,—I send you a sketch and description of a small, simple, and inexpensive apparatus, by which water may be procured, in a building of any height, without forcing pumps, cisterns, or any other of those clumsy contrivances, to which persons, who require such a supply, are now obliged to resort, and which are continually out of repair, and, if not, require incessant labour and trouble. The present apparatus is so simple, that nothing but the most culpable carelessness can derange its working. I shall be obliged by your giving it an early place in your valuable work.

I am, &c.
W.

Explanation of the Engravings.

A is a jar, which may be made of tin, of any size most convenient.

B a pipe, with a stop-cock, communicating with the well or cistern at the bottom of the house, from which the water is to be raised.

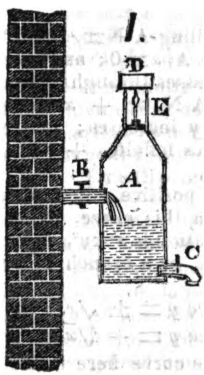
C a stop-cock for the egress of the water.

D the cover of the jar, which must screw on, so as to make it airtight.

Fig. 1 shows the machine in full operation; to effect which (both cocks being turned off), a lighted candle or taper E must be placed in the jar, and the top closed. The cock B must then be turned, and the water will rush in as fast as the air is consumed by the flame. When

it is conjectured that it is nearly full, the cock B must be turned off, the cover unscrewed, and the cock C turned on; when the water will flow out, as represented in fig. 2. The operation will be very quick, except the first time, when all the air in the pipe as well as the jar must be consumed; after that the pipe will, of course, remain full of water, which, as soon as the cock B is turned, will commence flowing.

It has struck me that warm water might be very easily procured at



elevated situations, by merely effecting a communication by a pipe with a kitchen boiler, as the force of the steam would send the water to a great height. There ought of course to be a safety valve, instead of a common cover, to the boiler, otherwise the steam would escape that way, instead of forcing the water.

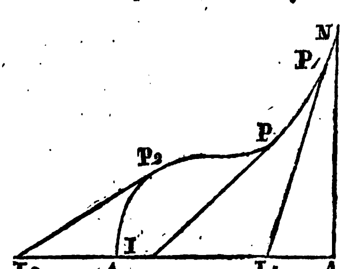
[We have little doubt that an apparatus on this principle—which is similar to that of Brown's Gas Vacuum Engine—might be made to operate effectually; but our correspondent (more than one initial of whose name the interference of the wafer has prevented us from decyphering) is mistaken in assuming that it would raise water "to any height." He has overlooked that the removal of the pressure of the atmosphere can only have an effect corresponding to the amount of that pressure; which has been long since shown to be only equivalent to a column of water of about 34 feet.—EDIT.]

AN ATTEMPT TO EXPLAIN THE PRINCIPLES OF FLUXIONS AND THE DIFFERENTIAL CALCULUS, WITH SOME ACCOUNT OF THE METHODS OF MENSURATION IN USE BEFORE THEIR INVENTION.

(Concluded from page 412.)

47. We will now proceed to give an instance of the uses to which the higher orders of fluxions may be applied.

Suppose A P P_1 to be a curve, which as far as some indeterminate point P is concave, and after that is convex to the axis A N, this point is called the point of contrary flex-



ure. It is evident that if P T be a

tangent to the curve, the angle P T N will keep continually decreasing as far as P; and after it has passed that point, it will begin to increase. Hence, at the point of contrary flexure, the angle P T N, and therefore its tangent, is a minimum. Similarly, if the curve be first convex and then concave to the axis, at the point of contrary flexure, the tangent of the angle P T N will be a maximum.

Now we must remember that in the fluxional calculus, $\frac{NP}{NT}=\frac{\dot{y}}{\dot{x}}$, and in the differential calculus $=\frac{dy}{dx}$; but $\frac{NP}{NT}$ is the tangent of the angle P T N; hence, in all curves, $\frac{\dot{y}}{\dot{x}}$ or $\frac{dy}{dx}$ is the tangent of the angle which the tangent of the curve makes with the axis. In order that these tangents $\frac{\dot{y}}{\dot{x}}$ or $\frac{dy}{dx}$, may become maxima or minima, their fluxions or differential co-efficients must be made equal to (0), or must vanish. Hence, when the particular curve which we consider admits the fluxion of $\frac{\dot{y}}{\dot{x}}$, or the differential co-efficient of $\frac{dy}{dx}$ to vanish; *i. e.* when $\frac{\ddot{y}}{\ddot{x}}$ or $\frac{d^2y}{dx^2}=0$, we know that it may have a point of contrary flexure, and can find that point.

Note.—If $\frac{d^3y}{dx^3}=0$, as well as $\frac{d^2y}{dx^2}$, $\frac{dy}{dx}$ is not a maximum or minimum, and there is no point of contrary flexure; but to say more than this would exceed our limits. In the cubical parabola, $\frac{d^3y}{dx^3}=1.\ 2.\ 3.$

Thus, suppose $y=x^3$, which is the equation to the cubical parabola,

$$\text{Then } \frac{\dot{y}}{\dot{x}} \text{ or } \frac{dy}{dx}=3\,x^2$$

$$\frac{\ddot{y}}{\ddot{x}} \text{ or } \frac{d^2y}{dx^2}=2.\ 3.\ x.$$

At the point of contrary fluxion, $\frac{\ddot{y}}{\ddot{x}}=0$; which is the case when $x=0$, or the curve has a point of contrary flexure at the origin.

48. We will trace the curve, in order more completely to explain our meaning.

Let x A x_1 be the axis, and A the origin.

Then, calling A N$=x$, and N P y at the point A, $x=0$; and therefore the curve passes through the origin. Now, as A N or $+x$ increases, N P or $+y$ increases; and when $+x$ becomes infinite, $+y$ becomes so likewise.

For the positive value of x we have not, in this curve, as in that whose equation is $x=y^2$, any negative branch, or a branch below the axis.

$$\text{There } y=\pm\sqrt{x}.$$
$$\text{Here } y=+\sqrt[3]{x}.$$

But in the curve here under consideration, if we measure in the direction A x_1, or make x negative, N_1 P_1 becomes likewise negative, and has no branch above the axis, but admits of one below, similar to the last drawn branch above; of which negative branch the common parabola does not admit; for if x is negative, $y=\pm\sqrt{-x}$, as is impossible.

We have before found, that at the point A the curve admits of a point of contrary flexure; and taking N P equal to A N^3, we shall have a curve with two infinite branches, as in the annexed figure.

49. Perhaps, in treating of these points of contrary flexure, the best way is not to suppose the symbol $\frac{\dot{y}}{\dot{x}}$ or $\frac{dy}{dx}$ to admit itself of a fluxion or differential, but to remember that its value $\frac{NP}{NT}$, when found in the particular curve in question, is a maximum or minimum at the point of contrary flexure, to make the fluxion of that value vanish, without at all using the expression $\frac{\ddot{y}}{\ddot{x}}$ or $\frac{d^2y}{dx^2}$. We shall thus avoid, in this case, the consideration of the differ-

ent orders of fluxions and differentials, and regard the value of $\frac{dy}{dx}$ merely as a new variable quantity, obtained by finding the fluxion of a former one, but which may be submitted to all the same operations as its original.

50. These higher orders of fluxions have also another use.

When, in case of a maximum or minimum, the fluxion of a quantity becomes evanescent, we require some test to ascertain by which of the two this is occasioned.

It is evident, if a variable, previously to its arriving at that magnitude which causes its fluxion to vanish, was increasing, that its fluxion must have been a positive quantity; but that that fluxion must have become smaller by degrees, until it vanished, when the variable became a maximum: hence the fluxion of the variable, decreasing at every step, must itself have had a negative fluxion; or the second fluxion of the proposed variable is negative, when the variable itself is a maximum. In the same way it will appear that the second fluxion is positive, when the variable is a minimum.

51. Since the tangent, which is represented by $\frac{\dot{y}}{\dot{x}}$ or $\frac{dy}{dx}$, in page 425, is a maximum or minimum at the point of contrary flexure, it will be a maximum, if its second fluxion $\frac{\dddot{y}}{\dddot{x}}$ or $\frac{d^3y}{dx^3}$ is negative, and a minimum if positive.

But when $\frac{\dot{y}}{\dot{x}}$ is a maximum, the curve is first convex to the axis; and when a minimum, it is concave.

Hence the curve is first convex, and then concave, if $\frac{d^3y}{dx^3}$ be negative; and first concave, and then convex, if $\frac{d^3y}{dx^3}$ be positive.

52. We have now endeavoured to explain the principles of fluxions; we have applied them to finding the lengths and areas of curves, and the surfaces and contents of the solids generated by their revolution. We have also drawn tangents to curves, and investigated the principles of the maxima and minima of quantities. We have done our best to draw a slight comparison between the fluxional and differential calculus, and have said something on the higher orders of fluxions and differentials; and conclude with reminding the reader, that this is but an attempt to smooth the first step, and to assist him in comprehending the principles of this most powerful mathematical engine.

DESCRIPTION OF MR. TELFORD'S DESIGN FOR A SUSPENSION BRIDGE AT RUNCORN.

(Concluded from p. 372.)

	Tons.	Lbs.
From Mr. Telford's calculations, the roadway in 1000 feet in length consists, of fir timber	430	920
Oak ditto	44	1440
Iron work connected with roadway; also in suspending rods and railway	98	428
Weight allowed at one time upon 1000 feet ..	100	
To be suspended upon 1000 feet	673	548
Say....	700 tons	

The above will show the weight the suspending cables have to sustain.

After Mr. Telford completed his design, he constructed a model of 50 feet in length, and 1-1200th part of the strength of the intended bridge; and although composed of wire only, and, of course, without proper joints or braces, it bore 3000 lbs., without any symptom of its parts being deranged.

All the essential parts of this stupendous work are so disposed as to admit of their being occasionally painted, or protected from the action of the atmosphere; and the whole being united so as to afford an opportunity of each part being taken

out and renewed separately, without materially affecting the strength of the bridge, the structure may, by these means, for any length of time, be preserved in a perfect state.

Estimate.

Masonry, &c. &c.	£25,598
Malleable iron, &c. &c.....	38,575
Roadway over the bridge ..	15,000
Earth-work in approaches..	2,000
Ten per cent. contingencies	8,117
	£89,290

At the time when this estimate was made, the price of iron was very low; the price of labour of all kinds was, also, much under what it had been for many years before; and circumstances seemed, at that time (March, 1817), favourable to this grand improvement. Many excellent stone quarries had been opened in the neighbourhood, and there were (and are still) water communications in all directions to the very spot.

With regard to the time of performance, Mr. Telford was of opinión that the whole might be completed in three years from the time of commencement.

The proposed site is in some respects favourable, it having, on the Cheshire side, a steep bank, and a bold rock down to the water's edge; also a projecting point of land of considerable elevation, with a flat rocky shore down to low-water mark.

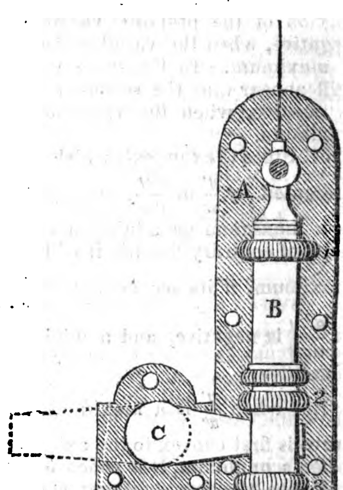
The channel (about 1000 feet) is occupied by a mass of sand and mud to a very considerable depth. This last circumstance would render the construction of any pier or embankment at this place, if not impracticable, at least very hazardous and expensive.

The advantages that would be derived from this proposed bridge are of considerable importance; for, by a communication over the river Mersey between the two great counties of Lancaster and Chester, the intercourse between the town of Liverpool and the Metropolis would be facilitated, as well as the South and West districts of the kingdom, and also tend materially to improve the communication between Liverpool and Ireland, by avoiding the present dangerous and uncertain passage of the Mersey. These advantages have frequently shown the propriety of having a bridge at Runcorn; and the late Duke of Bridgewater, above twenty-six years ago, had it in contemplation, and employed an engineer to make a survey of the site. Although, from various causes, the idea has lain dormant, or, after being meditated, has, for the time, discontinued; yet subsequent conviction of the great utility of such a communication has, from time to time, revived the plan, which has always been considered by ingenious men as practicable.

I am, Sir,
Yours, &c.
TIM BOBBIN.

Manchester, Feb. 1828.

BED-CHAMBER BOLT.



Sir,—The "Son of a London Watchmaker" has, at page 344, furnished your readers with an improved bed-chamber bolt. As he states, that all the bolts for a similar purpose that he has met with have been of a most clumsy description, I am induced to furnish a description of one in my possession,

which, so far from being *clumsy*, is equal, if not superior, to that of your correspondent. It is of brass, but by no means of modern construction. The above drawing, on a scale of five inches to a foot, will render its construction intelligible. On the bed plate A are fixed three rings, 1, 2, and 3; within these rings slides the bolt B, always retained in its present position by its own gravity, but prevented from falling lower by a projecting rim on its surface, which allows it to play between the rings Nos. 1 and 2. This part of the apparatus is fixed to the door post. On the door is fixed a small bar C, revolving on a bed plate, so constructed as not to allow it to fall below the horizontal position. The bolt B is raised when the door is to be shut, which having been done, the bolt is allowed to fall into its natural position, with the bar C behind it; the door cannot then be opened until the bolt is again raised, which is effected by means of a wire and bell-cranks, the handle of which hangs by the bedside.

When not in use, nothing more is necessary than to turn back the bar C into the position shown by the dotted lines. From the great simplicity of this night bolt, it is not likely to become deranged or out of order,—a frequent occurrence with those in which springs of any kind are employed.

I am, Sir, yours, &c.

WM. BADDELEY, Jun.

SWIFT SAILING VESSELS.

Sir,—In No. 247, p. 247, I observe some remarks on the construction of sailing vessels, with lines representing the stem, and dotted lines to show the sweep of the deck or gunwale.

Perhaps the architects in this important business will excuse the liberty I take in suggesting the idea, that the best construction for fast sailing vessels must be that which receives the least resistance from the element through which it has to be propelled, and that a lesson from nature may not be unworthy of their notice. I observe that all water-fowls, and animals that swim on the surface, when pursued, or endeavouring to make a rapid progress on the water, stretch their necks forward with the utmost force, and draw up the breast, forming a front something like the last of those to which I have alluded; but as to the sweep of the fore-deck or bow, I think it will be found that the nearer it can be brought to the form of the cuneus, or wedge-like form, the better. I should think that a more flatted bottom than is usual would be no obstruction to speed, as it would give greater buoyancy, and consequently afford more freedom to the water-way; for the deeper the draw, the heavier, in my opinion. And I think also that great regard should be paid to the stern quarters, &c., that the ship may leave free in the wake.

Perhaps I do not use technical terms, like a practitioner; but if the hint excite the attention of practical men, my intention will be fulfilled.

I am, Sir, yours, &c.

R. JACKSON.

WEIGHT OF THE EARTH AND PRESSURE OF ITS ATMOSPHERE.

Sir,—Many curious ideas may arise out of the speculative sciences of pneumatics and hydrostatics, which may afford illustrations of more useful consequences than the simple exposition of the inquiries propounded; and that which seemed only curiosity, has often suggested the most valuable inventions: for it is by the combination of the powers of the elements, that the operations of nature are performed, and to the use and application of which the arts are indebted for their noblest productions. All this being admitted, no further apology will be wanted for the introduction of the following questions.

1*st*. Supposing the earth's atmosphere to be 50 miles high, surrounding its surface, what will be the weight of a column of air pressing on a surface of 12 inches diameter, air being 800 times lighter than water, and taking 1 pint of water at 19 ounces?

2*nd*. By the same ratio, what will be the weight of the whole

globe of the earth, floating in such an atmosphere, and sustained thereby?

R. JACKSON.

THE NEW PALACE.

We quoted in our last an observation of the Committee of the House of Commons, appointed to inquire into the proceedings of the Board of Works to this effect,—that the defects in the design of the New Palace, which have led to so many expensive alterations, could scarcely have been overlooked in the first instance, "if a *model* of the entire edifice had previously been made and duly examined." Our correspondent, Mr. C. Davy, of Furnival's Inn, authorizes us to state, that a model of the edifice *was in existence twelve months ago;* that he examined it closely; that it was of considerable size, and seemed complete in every part; and that it had no appearance of being newly constructed.

NEW PUBLICATIONS.

Algebraic Exercises; being a set of Examples on all the Rules in Algebra, with a Collection of New Questions, producing Simple and Quadratic Equations. By HENRY OTTLEY, Author of a "Popular Introduction to Algebra," &c. pp. 44. 18mo. Cowie and Strange, 1828.

When we recommended to the favour of our readers Mr. Ottley's "Popular Introduction to Algebra," we took occasion to suggest to him, that he had only to publish an Appendix of well chosen examples, in order to perfect his work, and render it "at once the cheapest book of its class, and no way inferior in practical merit to the very best and dearest." Mr. O. has done us the honour to follow our advice; so far, at least, as to publish, by way of companion to his "Popular Introduction," and at the same low price, (1*s*.), the book of Exercises now before us. He appears to us to have executed this supplementary task very judiciously: the exercises are in general apposite, and of every necessary variety; many are entirely original (some of the best are so), and others newly translated from the French and German. Altogether, the work forms a most suitable companion to "the Popular Introduction," and, with the help of both, no person can be at a loss to make himself master, in a short time, of the valuable art of which they treat.

The Scientific Irrigator. Nos. 1, 2, & 3. Edinburgh. 1828.

To give a book a title which conveys no idea whatever of what the book contains, is a very foolish conceit; it is to stumble at the very threshold of the temple of Fame. Any person would expect, from the title of the publication before us, that the object of it is to instruct land-owners and farmers how to *irrigate* their fields *scientifically*. We were full of this impression when we took it up, and were not a little disappointed to find, on examination, that it has as little to do with the irrigating of fields as with the concerns of the people in the moon. "The design of this little publication," say its editors, "is to lead off streams of information from our great currents and reservoirs of scientific knowledge, and to let them flow in such a manner, that they may enrich and fertilize those fields over which they are diffused."—*Preface*. Since the editors were so pleased with this metaphor, that they must needs embody it in their title, they would have effected their purpose better had they styled their publication, "*The Scientific Watering Pan;*" a homely appellation, it is true, but one which there would be some little chance of persons understanding.

The body of the work, judging from the specimens before us, is scarcely deserving of more praise than the title. The editors have, no doubt, filled their *pan* from the wells of science, but it must have been after first throwing in loads of rubbish, and while the waters were yet dark and turbid. A good filtering machine, had they thought of trying one, would infallibly have been choked up in five minutes. The lumps of jargon which they have thrown in, would of themselves have prevented the water from ever running clear. Two or three of these lumps we have had the curiosity to analyse, and the following we find to be their component parts.

Inertia.

"Inertia expresses the *resistance* which *inactive* matter *makes* to a change of state."

Analysis.

Impossibility	90
Mystification	5
Verbiage..............	5
	100

See Dr. Young's "Natural Philosophy," p. 26.

Weight.

"Weight is an *effect* of the power of attraction, without which bodies have no weight whatever."

Analysis.

Fact	0
Reason	0
Absurdity	100
	100

Elasticity.

"The return of elastic bodies to their natural form is not made suddenly, and by a single motion in a direction contrary to that which produced the change of shape; *but the moleculæ of these bodies perform vibrations which transport them successively on this side and that side of their original positions, and which continually diminish, until the moleculæ have all recovered those positions.*"

Analysis.

Evidence	0
Probability	0
Conceit	50
Dogmatism	50
	100

Elastic Fluids.

"The moleculæ of these fluids are similar to so many little springs which are compressed when any cause whatever tends to bind up or enclose a mass of one of these fluids in a smaller space than that which it previously occupied, and which afterwards return to their usual state, when the compression ceases to have place, the mass of the fluid taking again, by dilating itself, the place which it has relinquished."

Analysis.

Words (a strange jumble)	73
Meaning	0
Conglomeration	27
	100

The "streams of information" which meander through the pages of "the Scientific Irrigator," are not all so puddly as these; but the same confusion of thought and inaccuracy of expression which are here displayed, prevail throughout the work, to an extent which puts it wholly out of our power to recommend it as a safe or useful guide to scientific knowledge.

MISCELLANEOUS NOTICES.

Rarity of the Air at Great Heights.—"I had provided," says Mr. Auldjo, in his narrative of an ascent to the summit of Mont Blanc, "a bottle of champagne, being desirous to see how this wine would be affected by the rarity of the air. I also wished to drink to the prosperity of the inhabitants of the world below me; for I could believe that there were no human beings so elevated as we were at that moment. The wire being removed, and the string out, the cork flew out to a great distance, but the noise could hardly be heard. The wine rolled out in the most luxuriant foam, frothing to the very last drop, and we all drank of it with zest. But not three minutes had elapsed when repentance and pain followed; for the rapid escape of the fixed air which it still contained, produced a choking and stifling sensation, which was very unpleasant and painful while it lasted, and which frightened some of the guides. A very small quantity was sufficient to satisfy our thirst, for nine of us were perfectly satisfied with the contents of one bottle, and happily its unpleasant effects were but of short duration. The most peculiar sensation which all have felt who have gained this great height, arises from the awful stillness which reigns, almost unbroken even by the voice of those speaking to one another, for its feeble sound can hardly be heard. It weighs deeply upon the mind, with a power, the effect of which it is impossible to describe. I also experienced the sensation of lightness of body, of which Captain Sherwill has given a description in the following words: 'It appeared as if I could have passed the blade of a knife under the sole of my shoes, or between them and the ice on which I stood.'"

Canal between the Atlantic and Pacific.—The execution of a canal across the isthmus of Panama, so frequently talked of, since the establishment of the independence of the South American States, is stated to have been at length seriously undertaken by the king of the Netherlands, who has sent out three engineer officers to make the necessary surveys. A company was formed for this purpose about three years ago, in London, which had the business taken out of its hands by a rival set of speculators in the United States, who anticipated them, in obtaining the necessary powers from the local government. Of the proceedings of the latter, nothing has been heard for a long time, and it is to be presumed that they also have abandoned the design, from its being now taken up by the government of the Netherlands. No project can be conceived better calculated to bring honour and profit to a nation than this; and while we admire the outstretching spirit of enterprize which has induced the Dutch government to embark in it, we cannot but regret that the credit of carrying it into effect should, by a mere misadventure (apparently), have been lost to our own country.

Influence of Light on the Colour of Plants.—It frequently happens in America, that clouds of rain obscure the atmosphere for several days together, and that during this time, buds of entire forests expand into leaves. Till the sun shines forth, these leaves have a pallid hue, but within the short space of one hour after they have the benefit of a clear sky and bright sunshine, their colour is changed to a beautiful green. A writer, in Professor Silliman's Journal, mentions a forest on which the sun had not shone for twenty days. The leaves had expanded, during this period, to their full size, but were almost white. "One forenoon the sun began to shine in full brightness. The colour of the forest," he says, "absolutely changed so fast, that we could perceive its progress. By the middle of the afternoon, the whole of these extensive forests, many miles in length, presented their usual summer dress."

Vegetable Rouge.—An excellent vegetable rouge may be obtained from the flowers of the *liatris scariosa* and *carthamus tinctorius*, which are sold by druggists under the common name of safflower. The following process for the purpose is given in the Number of "Maund's Botanic Garden" for May:—Wash safflower till no stain is given to the water, then dry it. Of this, take half an ounce; infuse it for a short time in a pint of water, in which a dram of the subcarbonate of soda has been previously dissolved; strain off the liquid, and add to it an ounce of finely levigated French chalk. The alkali will hold the colouring matter of the safflower in solution, and the chalk will remain colourless; but by adding a little tartaric or citric acid, the alkali will be neutralized, and the red colouring matter, which is not soluble in simple water, being set at liberty, will fall to the bottom combined with the chalk. Thus a beautiful pigment is produced, which may be dried and further levigated for spreading on saucers; or, ground with a drop or two of olive oil, it will form the Spanish vegetable rouge. Liquid pink dye is a similar preparation, with a proportion of spirit of wine.

Herschel's Discoveries anticipated.—It has more than once occurred, that the most brilliant discoveries in science have been anticipated by ingenious reasoning or conjecture. In this manner, Sir Isaac Newton conjectured that the diamond was combustible, long before it was proved by experiment that it consists of carbon. On dipping into one of Addison's "Tatlers," the other day, we fell by accident upon a very remarkable passage, which completely anticipates the great discoveries which Herschel made, by sweeping the Milky Way with his powerful telescope. The passage in the "Tatler" runs thus:—"What you look upon as one confused white in the Milky Way, appears to me (the good genius) a long track of heavens, distinguished by stars, that are arranged in proper figures and constellations."—No. 119.—This is precisely Herschel's account of the Milky Way, from observation; he having found the white light, only apparent to the naked eye, to consist of hundreds of stars, each of them in his opinion the centre of a solar system, analogous to our own.—*Athenæum.*

The House Fly does not enter houses till the wet or cold of autumn drives them in, but there is another fly which, exteriorly, much resembles it, and which is often troublesome during the ensuing (midsummer) months: this is the stomóxys cálcitrans, or stinging fly; one of the greatest plagues to cattle, as well as to persons wearing thin stockings.—*Magazine of Natural History, No. 2.*

Perpetual Motion.—Sir,—This subject has so frequently occupied your attention, and that of your contributors, that the following advertisement in the "Edinburgh Courant," 15th Dec. 1707, may probably be thought worthy of a corner in your valuable work. "These are giving advertisement that in pursuance of some overtures given in by Mr. Robert Stewart, Minister of the Gospel, in January and February last, in the Edinburgh Courant, concerning the *perpetuum mobile*, and for the further satisfaction of mankind, and clearing their scruples, anent the same; there was a curious model made at the charges of John, Earl of Breadalbane, which model will demonstrate the possibility, probability, and practicability, of these three new discoveries, viz.:—*firstly*, a balance, by which an equal overcomes an equal at the same time. *Secondly*, that being granted, a weight always going down, and never going lower. *Thirdly*, these being granted, a clear idea of the *perpetuum mobile*. If any man doubts any of these propositions,—the model is brought to town, &c. &c." Can any of your readers give us any further account of the *perpetuum mobile*, here spoken of, or its author?—I am, &c., R. S.

Effect of Sunshine on Colours.—Sir Humphry Davy, in an entertaining little volume with which he has just favoured the public, entitled "Salmonia, or Days of Fly Fishing," gives the following curious anecdote:—"A manufacturer of carmine, who was aware of the superiority of the French colour, went to Lyons for the purpose of improving his process, and bargained with the most celebrated manufacturer in that capital for the acquisition of his secret, for which he was to pay a thousand pounds. He was shown all the processes, and saw a beautiful colour produced, and he found not the least difference in the French mode of fabrication and that which he had constantly adopted. He appealed to the manufacturer, and insisted that he must have concealed something; the manufacturer assured him that he had not, and invited him to see the process a second time. He minutely examined the water and the materials, which were the same as his own; and, very much surprised, said, 'I have lost my labour and my money, for the air of England does not permit us to make good carmine.'—'Stay,' says the Frenchman, 'do not deceive yourself; what kind of weather is it now?'—'A bright sunny day,' said the Englishman; 'and such are the days,' said the Frenchman, 'on which I make my colour. Were I to attempt to manufacture it on a dark or cloudy day, my result would be the same as yours. Let me advise you, my friend, always to make carmine on bright and sunny days.'"

The Alligator.—The author of "Recollections of Venezuela and Columbia" was informed, by the Indians of the Oronoco, that previously to the alligators of that river going in search of prey, they always swallow a stone, that by the additional weight of it they may be enabled to dive with the greater celerity, and drag whatever they may seize under the water with them with ease. Not giving implicit credit to this statement of the Indians, he mentioned the matter to President Bolivar, who not only assured him that the Indians were correct, but proceeded to shoot some to convince him. In every one, when opened, there were found stones, varying in weight according to the size of the animal; the largest killed was about seventeen feet in length, and had within him a stone weighing about sixty or seventy pounds!

NEW PATENTS.

Daniel Jobbins, of Uley, Gloucestershire, millman, for an improved method of milling and scowering woollen cloths, and other fabrics.—3 June—2 months to specify.

Baron Charles Wetherstedt, Commercial-road, Middlesex, for a liquid, or composition for waterproofing or strengthening leather.—4 June—6 months.

Richard Wittey, of Hanley, engineer, for certain improvements in apparatus for making and supplying coal gas for useful purposes.—10 June—6 months.

INTERIM NOTICES.

Marylebone.—We have received several more letters on the subject of establishing a Mechanics' Institution in this quarter of the metropolis, and are glad to learn that measures are in progress for carrying the project into effect.

Communications received from Mr. Harrison—Mr. Shires—P. P. A.—F.—M. J.—Inkhorn—W. Lawson—An Indian—Julius.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-Row, London.

Printed by G. Duckworth, 76, Fleet-street.

Mechanics' Magazine,

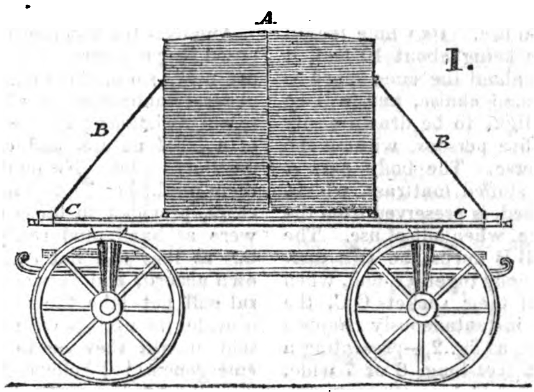
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 259.] SATURDAY, JULY 26, 1828. [Price 3*d*.

" Reason and revelation unite in teaching us, that in the developement of the passions we must advance from the private to public affections, and that extended benevolence is the last and most perfect fruit of individual regards."

REV. ROBERT HALL.

HUDSON'S FIRE-ESCAPE.



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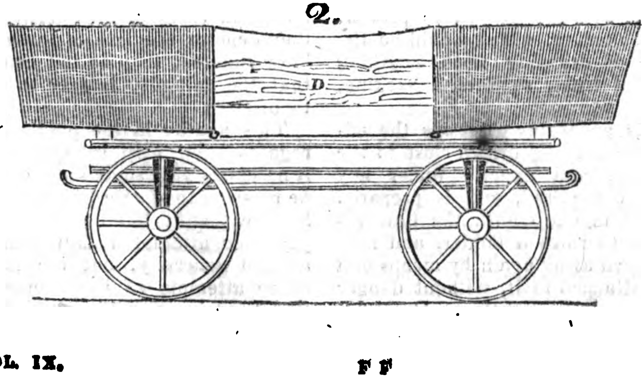

HUDSON'S FIRE ESCAPE.

Sir,—As you have laudably appropriated some columns of your useful work to the subject of fire escapes, and have intimated your intention of publishing some more communications, perhaps you will be inclined to devote a page to a few remarks, and a sketch of one mentioned by Mr. Baddeley in your Magazine, No. 251, of the 7th of June, which is calculated for the reception of persons when driven to the dreadful necessity of precipitating themselves from windows, &c.; and as he has correctly described it, and candidly given his opinion upon it, I shall simply explain the drawing, presuming that your readers will easily comprehend its utility.

Fig. 1 is a profile of the machine when not in use. Its whole length in this state being about 10 feet, it will occupy about the same space as a four-wheeled chaise, and will be sufficiently light to be drawn easily by four or five persons, without the aid of a horse. The body part A contains a stuffed mattrass, which, being enclosed, is preserved from the weather, &c. when out of use. The two irons B B keeps the two divisions of the body together, and, when lifted out of their sockets C C, the apparatus instantaneously adjusts itself for use, as fig. 2,—presenting a platform 12 feet long, 6 or 7 wide, and about 5 feet from the ground, covered with the mattrass D, into which a person might drop from a second floor window with great safety; it being so stuffed as to sink a little with the weight, to prevent its rebounding, which would be the effect of dropping upon anything strained tight, such as a sacking, &c.

This apparatus possesses the advantage of being drawn close to the building, and exactly under any window required, and is prepared for use in one eighth the time required to raise a ladder, and may be drawn away again by means of a rope attached to it, without danger to the persons assisting. It might, also, be of great benefit on almost all occasions; for, if no lives were in danger, it might be the means of saving a great deal of property, which could be thrown into it from the upper part of a house, without being injured; and as accidents frequently happen, whereby some one or more get severely injured, this machine would, in that case, be a safe and easy conveyance to an hospital or elsewhere, instead of the painful and dangerous method generally used of carrying them on a door or shutter upon men's shoulders.

I take the liberty to suggest, that if one or two were stationed in convenient parts of each parish, and a small premium offered for its early arrival, and a proportionable reward for any lives or property saved, there would always be plenty of persons to run for them, and to exert themselves in using them.

Amongst the numerous plans proposed by your correspondents, there are only two or three calculated for general application, by affording external assistance; all the others are of a local nature, and can be but partially useful. No doubt many of them might be effectual in particular cases, provided in those cases they were at hand, and ready for use; but as they will not come of their own accord, and as people in general will not take the precaution to provide themselves with them, how seldom will they be to be had in emergencies! I believe, Mr. Editor, if we were to search London through (notwithstanding the many fatal accidents still fresh in our recollection), there would scarcely be found twenty persons provided with any means of escape in cases of fire; for, though they deplore the fate of those who have suffered, they do not conceive that the calamity is ever to reach themselves.

This apathy in the public, as it regards their own safety, renders it necessary that some means should be resorted to of affording assistance from without; but nothing has as yet been attempted that could be applied generally, but the ladder. Some attempts at improvement in that have been made, by rendering it more portable,—but it is still a ladder; and when it is considered

how difficult and dangerous it must be for a person (even when perfectly composed) to get out of a second floor window on to a ladder, and how much more difficult it must be when agitated with the terror of surrounding perils, beside the impossibility (almost) of women or children availing themselves of the little benefit it offers,—it is natural to conclude that some more effectual method of escape is requisite.

The expeditious elevator (a print of which is given in your Magazine, No. 247, of May 10) might answer some of the purposes mentioned by your correspondent, but, I fear, would not be effectual as a fire escape: the frame requiring to be so strong and heavy would render it very cumbrous; so that, unless mounted upon wheels, it would not be portable; and then the length of lever, when at its extent of elevation, with the weight of a cradle or platform at top, would assuredly overturn it; and it will be seen by the engraving that, when elevated, the rods at the lower part are drawn so near together, as to deprive it of sufficient support at its base.

The plan of Mr. Buston's, which is strongly recommended by Mr. Baddeley, is very simple, and not expensive, viz.—a large sheet of canvas (say an old sail), strengthened by netting on the under side, and having strong loop-holes all round the edge, so as to be held by seven or eight persons, breast high, would, in many cases, be of great utility; for though a person dropping on it might bring it to the ground, it would break the fall, and prevent his receiving material injury. The only inconvenience I perceive in it is, that, as it must be brought close to the house on fire to receive the person dropping into it, some of those holding it must of necessity be so close as to place them in a dangerous situation. It is not my intention to depreciate the merit of Mr. Buston's invention; on the contrary, I consider it well worthy public attention, and should be glad to see it adopted, but do not see the several advantages alluded to by Mr. Baddeley over the one before you; though I know he considers the principal one to be, that it does not go on wheels (to which he expresses a great aversion): but I would ask, what should prevent an apparatus upon wheels being brought to the spot with as much facility as one that is to be lugged there on a watchman's shoulders? I have always considered that the most expeditious, and least laborious, mode of conveyance is that upon wheels.

These are the only external means of affording relief that I have yet been able to discover; and I flatter myself that you will coincide with me in opinion, that it behoves the parish authorities to adopt one or more of them, as the expense would be trifling compared with the probable benefits that may be derived from them. The ladder and its effects may be seen at Mr. Gregory's, near Bagnigge Wells. Mr. Buston's is so well described by Mr. Baddeley as to be easily comprehended; and I have made a model of mine, which fully explains its use, and which may be gratuitously inspected by any persons who may feel inclined to promote the means of saving the lives or property of their fellow-creatures.

I am, Sir,
Yours, &c.
JOHN HUDSON.

16, Poole-st., New North Road,
(late of City Gardens.)

SUPPLEMENTARY COMMUNICATIONS ON FIRE ESCAPES.

Sir,—In my communication to you (No. 247), I forgot to mention a method of conveying a line, &c. to a person at a window of a house which is on fire, which was suggested to me by a particular friend of mine. It is the same in principle with Capt. Manby's mode of projecting a line to a ship's crew on the brink of shipwreck. In place of using any species of gunnery, we propose to have a metal ball, of a convenient size (2 lbs. or more, as circumstances may admit), cast with a loop, in order to fix a line to it. Any person might easily cast such a ball into a second or third floor window, when

a ladder (rope), or any other suitable apparatus, might be drawn up, and secured by the person requiring assistance.

I am, Sir,
Yours, &c.
A Member of the Richmond Mechanics' Institution.

Richmond, May 29, 1828.

Sir,—Having sent you a communication on fire escapes, signed "T. D.," which you did me the honour of noticing, in No. 248, p. 262, I am induced to offer a word or two more on the subject. The plan of shooting the line of the chain ladder into the window would, I think, be attended with hazard, and, perhaps, loss of time. It occurs to me, that iron rods, made about 10 feet in length, and jointing one into the other, with a small wheel at the end of the uppermost one, would answer better. They would certainly enable a man to raise, with ease, a cord to a window fifty or sixty feet high; and there are not many houses of greater elevation. The purpose of the wheel on the top rod is, that the apparatus may be lodged against the house, and pushed up, so as to prevent its overbalancing the person applying it. I should be most happy to see Mr. Hudson's plan brought into operation; it could not fail to be of excellent service in preventing the recurrence of such fatal accidents as have of late so frequently occurred.

I am, Sir,
A Well-wisher to Fire Escapes,
THO. DOLLEY.

10, *Exmouth-st., Hampstead Road, June* 2, 1828.

MECHANICAL GEOMETRY—SEPTENARY SYSTEM.

Sir,—In order to give the most clear idea of motion by a diagram, I distinguish the exact quantity of line, whether right or curved, which is acted upon.

The diagram, fig. 1, is intended to explain the motion (which harmonizes with a case of epicycloidal motion) by which the cardioid of M. Carré is produced. While the

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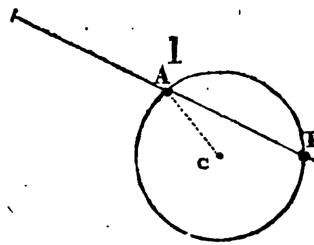

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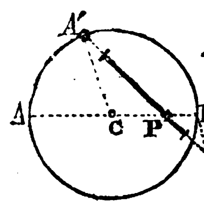


point A describes the circle *once*, the right line, which is twice the diameter of the circle, and extended equally from A, will slide from one end to the other, against the point P.

In the diagram fig. 2, to explain the motion of "F.'s" problem, the length of the right line, which is moved against P, while A′ describes the circle, is only AP—PB, the length of which is shown by the continued right line; but the right line is moved twice its length, that is, backward and forward, against the point P, while A′ performs one revolution.

If P be placed half the radius from the circumference, then the length of the right line which would move against it will be equal to the radius.

Either extremity of the right line in fig. 1, will describe the same cardioid. But, although both ends of the right line in fig. 2 describe lines with cusps, they are neither equal nor similar to each other, or to the cardioid produced by fig. 1.

The nature of the alteration produced in the motion, by shifting the point P from the circumference, as it is in fig. 1, to its position within

the circle, as it is shown in fig. 2, will, I trust, with this explanation, be more evident to your readers.

I had prepared the above for the Mech. Mag. previously to receiving No. 238, containing "F.'s" second letter on this subject.

In his first letter he said, "I will demonstrate (if necessary) that the curve engendered is an epicycloid." And as I did not consider any of the curves of the particular case his problem referred to were epicycloids, I, in consequence of his offer, requested he would favour your readers with his demonstration, and to describe its reverse operation: to accomplish which, if the lines are epicycloids, need not, I should suppose, "require a volume."

The ellipse is a line of the second, and the cardioid a line of the fourth order. To investigate the latter is, of course, not so simple an operation as the former. But it has occurred to me, as the ellipse is the path of a point upon one surface connected with another surface, a point upon which would at the same time describe a cardioid upon the former; and as certain lines generated by points upon the one, have some circumstances either equal or bearing certain proportions to the properties of the paths of certain points upon the other;—whether the investigation of the ellipse may not assist the investigation of the cardioid.

Thus, a point upon each plane or surface may be called its centre. Each of these centres at the same time describe circles of the same diameter; but while the elliptic plane makes one revolution, the cardioidal plane makes two. Again, another point upon each, at equal distances from their centres;—the one on the elliptic surface will describe a right line (backward and forward), while the point upon the other describes the cuspated cardioid, being equal to the right line. Further, there are three methods in the Septenary System of generating the ellipse; but each of these is not equally simple. And perhaps the methods of investigating the cardioid have not had reference to its most simple mode of generation. The usual method by which its mode of description is represented, is on the principle of the 1st fig. in this communication; but the most simple method is that described, No. 211, p. 116.

"To particularize" (his problem) "still farther," "F." now says, "that the point P may be supposed to be at the extremity B of the diameter;" which is the position I pointed out (although "F." writes as if he had not seen that part of my letter) as being necessary to produce a curve, which may also be produced by one of the cases of motion of which one of two wheels connected together is susceptible; when the line described would be called an *epicycloid*.

But if P be in the circumference of the circle, the problem, I should think, will not be the same; and a third problem or case will arise, if the point P be placed at any distance from the circle.

I am not quite certain whether I rightly understand "F.;" but it appears to me, from what he now says, that a *part only* of the curve engendered, and not the *whole*, as he first stated, is epicycloidal—the other portion being, as he states, "a particular conchoid." "F." says that a quantity of the curve,—if I do not mistake, not quite one fifth,—is an epicycloid; and then he says, one half of it is called *Pascal's Snail.* Now the other half is exactly similar; therefore the whole is Pascal's Snail, and no portion is left for an epicycloid. Perhaps there is some error.

If "F." can demonstrate that a part of the line is epicycloidal (although at present I doubt whether he can do so), it would strengthen an idea which I have long entertained, that a part of some curves which I can generate, which resemble a semi-ellipse, may, under some particular adjustments, actually be so.

"F.'s" definitions are to me by no means satisfactory. That for the conchoid comprehends such a variety, that it becomes almost as inde-

finite as the word curve; and some lines which that term ought, I think, to comprehend, are by that definition excluded. The definition of a cycloid is equally objectionable. The same may be said of the definition of an oval, which Mr. P. Nicholson has given in his "Architectural Dictionary."

I may also notice here, that Mr. Nicholson's definition of a *plane* curve, in his "School of Architecture, &c." is too indefinite. He says, "Every curve is called a plane curve, when a plane will pass through all its points." In this sense, all the complicated lines produced by Mr. Child and Mr. Ibbetson are plane curves, as well, indeed, as the representation of any curve whatever on a plane. Admitting that the term is proper, still something more is required to distinguish those curves produced by simple, from those by complicated, principles. When Mr. Nicholson says, "A knowledge of plane curves, and of their tangents and normals, so as to describe them conveniently in every application, *is a most necessary accomplishment to all concerned in the execution of design*," I do not suppose he means *complicated* curves; I would therefore submit, whether such lines as can be conveniently described, may not be distinguished by calling them *simple* plane curves? and perhaps all the curves produced by first principles may be included under that term. Such as are produced by combinations of principles may be distinguished by terms expressing the degree of complication.

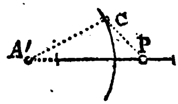
With the same principles for regulating motion which are required for generating the conchoid of Nicomedes, namely, one pole and right line at rest, and one pole and a right line in motion, I form *six cases*. These admit of a great variety of problems, and produce both symmetrical and dissymmetrical lines. To call them all conchoids, is to say that the cissoid is a conchoid; but they certainly may, with as much propriety be all called conchoids or all cissoids, as to apply the term *epicycloid* to all the curves produced by the *six* cases of regulating the motion of a surface by two wheels.

I have stated (No. 231, p.435) that "the conchoids are cardioids, having some quantity become infinite;" and I have shown by diagrams, how a gradual connexion may be traced from the one to the other. But to call the cardioid a conchoid, is to say that an epicycloid is a conchoid; and, on the same principle, the ellipse, &c. are all conchoids. I consider it quite impossible, without a general knowledge of the Septenary System, to give any correct definition of the terms conchoid, cissoid, or cardioid. It may be proper to call the lines produced by particular or extreme variations of adjustments by these words; but the lateral and intermediate gradations ought to have terms so expressed as to show their *degree* of relationship,—something in the same way as *sub* and *super* are employed in chemistry.

I should be glad to know if "F.," in his "Treatise of Conchoids," has any observations on the lines produced by the reverse operation of the method for producing the conchoid of Nicomedes,—some of which I have called *infinite ellipses*, because a gradual connexion may be traced between the common ellipse and those lines, in a similar way that the connexion is traced between the conchoid and the cardioid. If "F." is acquainted with these lines, perhaps he will have the goodness to favour your readers with a diagram to explain the nature of the motion; if not, I will give you mine at some future opportunity. Or if "F." will undertake to state generally, in your pages, whether his Treatise extends to all the lines connected with the cycloids and conchoids; and whether those divisions of my system do or do not comprehend lines which have not hitherto been noticed,—I shall feel much pleasure, if he will favour me with a call, in showing him specimens, and explaining their several modes of generation.

The reverse motion of the first fig. now given is the motion described

by the second fig. (p. 216, No. 245.) The reverse of "F.'s" problem, which, as he has not described it, I now give, is thus:—



While the point P *describes* the right line, the point C (the centre of the circle in "F.'s" problem) describes the arc, of which any point A′ in the circumference is the centre.

I am not aware that my former notice of "F.'s" problem can be misunderstood; but the conjunction *and* should be introduced after the letters "A B" in the first paragraph.

I do not comprehend the first part of "F.'s" N.B.

I am, Sir,
Yours, &c.
JOS. JOPLING.

[About the same time that we received the preceding communication, "F.'s" solution of the problem referred to made its appearance in No. 256. This has produced from Mr. Jopling the supplementary remarks which we subjoin.]

Sir,—"F." has now favoured your readers with a solution of the problem proposed, not by me, as is now stated, but by himself.

Whether the solution be correct or not, I will leave it to your professed mathematical readers to determine. I may, however, just observe, that "F." commences his solution by supposing that the pole is within the circle; and afterwards he proceeds as if the pole were placed in the circumference. He says, "Let us produce B H perpendicular to A B, and it will be equal to it, since it is the generant in its last position." Now, in no other situation of the pole but when it is in the circumference, can B H, when perpendicular to A B, be equal to it.

Again, "F." says, "In fact, this curve is absolutely the same as the epicycloid engendered by two equal circles, the diameter of which is 2 *a*." Now, to produce a cuspidated figure with the motion of one wheel rolling upon another wheel of the same size, that shall be equal in diameter to another cuspidated figure produced by "F.'s" problem, when the pole is in the circumference of the circle, each wheel must be of the same diameter as the circle; that is, only equal *a*. But although, by both these principles, cuspidated figures of the same diameter may be engendered, I have not considered them "absolutely the same." On the contrary, I have considered that there is a difference, and that the difference is similar to the difference between the cuspidated conchoid of Nicomedes and the cissoid; the conchoid being the infinite of the cardioid, and the cissoid the infinite of the epicycloidal line produced by two equal convex circles. Be this as it may, it is, however, certain that if the motion of one surface be regulated by the right line, and another surface by one of the wheels, the two surfaces will not have the same motion. The epicycloidal motion, which harmonizes with the motion of "F.'s" problem, when the pole is in the circumference, is produced by one wheel double the diameter of another placed within it; that is, the *concave* upon the convex.

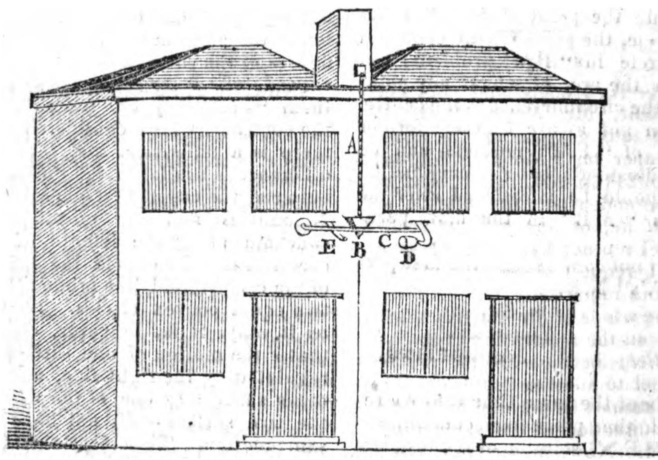
I so far agree with "F." in his concluding observations, as to suppose that the names given to some curves are not proper; but I think the cuspidated line, called the cardioid, is as properly named as those called the conchoids of Nicomedes. The first, certainly, more resembles a *heart*, than the second a *shell*. If, however, the line now called the cardioid had been known by the name of conchoid in the time of Nicomedes, that mathematician, might perhaps, with propriety, have called the line, which he is said to have discovered, an *infinite* conchoid,—since it is, as I have shown (vol. viii. p. 435), the infinite of the cardioid.

That the cardioid was known to the ancient Greeks I have ventured to suppose, from the circumstance of my being able to produce the Ionic volutes by that motion; and I think that the above idea will rather strengthen than diminish the force of that reasoning. Perhaps "F.'s" researches will throw more light on the subject.

I am, Sir,
Yours, &c.
JOSEPH JOPLING.

[For some observations relating to the preceding communications, see "Minor Correspondence," last page.—EDIT.]

FIRE ALARM.



Sir,—A Constant Reader of your "Mechanic's Magazine" from its commencement, seeing many good plans for escaping from the windows of the upper stories of houses on fire, takes the liberty to propose one, by which timely notice may be given to those in the house to escape out of the doors below, and also to the watchmen in the streets.

Let small cord or line be dipped in any chemical preparation that will quickly take fire, stretched under the ceilings, through the staircases, passages, and from one room to another, like the bell strings in an inn, beginning at the cellar, kitchen fire-place, and ending at any of the upper chambers. To the end of this let there be fixed a piece of wire, passing through to the outside of the house as at A, to which there should be hung an iron weight in the form of a wedge as at B, passing between the pendulum rod C and the wall. At a small distance from the weight hangs a bell, with a pendulum fixed to it as at C D, supported by an iron pin driven into the wall as at E. At the other end of the line, in the cellar kitchen chimney, hangs another weight, to which is tied a short piece of wire, the end of which is tied to the trigger of a gun, loaded with powder, in the chimney. Should fire break out in any part of the house, the line takes fire first, and breaks at the same instant; the weight in the chimney falls, and fires the gun; likewise the wedge weight B falls, and throws off the iron pin E, the pendulum rod C, vibrates and rings the bell D.

I am, Sir,
Your Constant Reader,
W. C.

Scarbro', June, 1828.

[There was a patent taken out some years ago by Sir Wm. Con-

greve and another for a fire alarm, which was constructed on the principle of the thermometer; a tube of mercury being so placed as to set a bell a-ringing, when affected by any extraordinary heat. We think this a much simpler and more efficient alarm than that of our correspondent. The great drawback, however, to all such expedients is, that they are not of a nature to be very generally adopted.—EDIT.]

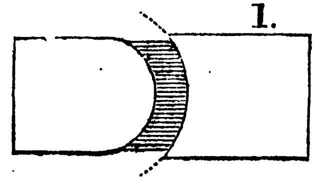
SCRIBING.

Sir,—As I apprehend your correspondent, Mr. James Curtis, has fallen into a considerable error in his paper on "*Scribing*," inserted in No. 244, p. 200, I shall, with your leave, endeavour to point it out: and if he, or any of your readers, think I am not free from error myself, I request them to state their opinions impartially.

The whole of Mr. Curtis's mistake turns on the application of the word *parallel;* because a line perfectly parallel to another line in one direction, cannot be parallel to it in any other direction at the same time, if curved. Now, in scribing, the line to fit must be parallel only in an *horizontal* direction, *i. e.* in the line the board is laid in, which is that which, on being scribed or marked, is to be moved onwards, or brought up to fit or meet, and no other; or, in other words, all the horizontal lines between the two edges must be exactly of the same length. Now, if the compasses are held parallel to the line as above said, in which the stuff is to be moved up after being scribed and cut, Mr. Curtis will find it quite correct, and have no occasion for his instrument; but the compasses must be continued in this position, and *no other;* because in no other can the lines or distances of the edges be *horizontally parallel*, or of the same length; and if not, they certainly will not come in perfect contact for a joint.

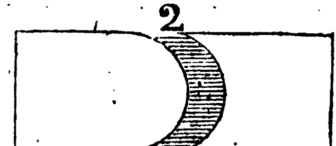
This can be proved in various ways:—first, a concentric circle cannot be parallel to another greater or less *horizontally*, *i. e.* to move up horizontally to fit the other; and this is clearly explained by drawing a number of horizontal parallel lines in the direction the stuff is to be moved up after being cut, as in the following figure.

1.



Now, it is clearly seen that the lines, instead of being equal lengths, which they should be, to make the edges horizontally parallel, are scarcely any two of them of the same length; consequently the two curves (although portions of concentric circles) are not horizontally parallel, and as certainly they will not fit when moved up, after cutting; because no two distances from any concentric circle to another can be equal, unless measured on a radius; and, by the nature of things, *no two radii can be parallel;* and a board, to meet another's edge, can be moved but in one direction only. Such is the case with concentric circles. On the contrary, the scribing compasses, if held right, would scribe a line of curve parallel exactly to that it is to meet, and its form will be thus:—

2

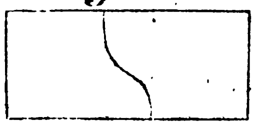


Here it is seen all the horizontal lines are of the same length; consequently the edges or curves are horizontally parallel, though not concentric, but exactly of the same size and form, and therefore will perfectly fit, making a proper joint as desired: but in the former figure, the compasses change their direction every instant they advance from their first position; consequently the line scribed so will not be horizontally parallel, and therefore will

never fit; which I suppose Mr. C. means by his first figure, to show that two concentric circles, when brought into contact, will only touch in one point.

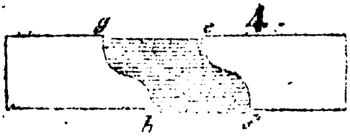
Again; take a square, or oblong square, piece of paper; cut it down in any form, except that of a right line, as in fig. 3, thus:—

3



then put them any distance apart, as in fig. 4, or thus:—

4.



Now, it will be clearly seen that every part of the line *e f* is equally distant horizontally from the line *g h* it was cut from; consequently the two curved lines are horizontally parallel, and must exactly fit, being contrary to the figure 1 of concentric circles, which could not fit, not being horizontally parallel: whereas, in figs. 2 and 4, all the horizontal distances are equal; therefore the curves or edges are parallel one to the other, and they will certainly fit mathematically when brought up together.

Mr. Curtis's figures are not correct as engraved. In fig. 4, the two ends of the scribed line already touch, but the middle does not; consequently it cannot be brought up nearer, or, in other words, cannot possibly fit, although done by the instrument; for when they once touch in any part, they cannot approach nearer than they then are. All of which is humbly submitted, by a friend to the "Mechanics' Magazine," and of Mr. Curtis.

AN OBSERVER.

Cranfield.

APPENDIX TO THE PAPER ON THE DIFFERENCE OF LONGITUDE IN TIME.

Sir,—As the above is a subject of some interest, you will, perhaps, have the goodness to insert a few remarks, by way of Appendix to my paper of July 1, which will, I trust, place the subject in a clearer light than has hitherto been done.

The computation which I instituted in my Example was for *Greenwich* time under both meridians. If, therefore, the time at Greenwich be subtracted from that indicated at P in Long. 120 degrees West, the remainder will be the difference in time, or the time the sun is passing from the meridian of Greenwich to that of 120 degrees West; which is obviously the difference of *apparent time* between *apparent* noon at the two places.

No one will dispute that 120 degrees of longitude are equal to 8 hours, either in *sidereal* or mean *solar* time; but I repeat that 8 hours of apparent time is *nonsense.*

The 8 hours of *sidereal* time is the time elapsed between the respective transits of a *fixed star* over the two meridians, and is 1 minute $18\frac{2}{3}$ seconds less than 8 hours of mean solar time; *i. e.* the star takes so much less time than the sun, in passing from one meridian to the other.

The length of the *solar* or *tropical* year is 365 days, 5 hours, 48 minutes, 48 seconds; that is, the earth revolves on its axis, in respect to the sun, 365·242222, &c. times in a solar year; each of which revolutions is divided into 24 hours, which constitute *mean* solar time.

But the earth's diurnal motion is *uniform* in respect to the *fixed stars only;* it is variable in respect to the sun, which has an apparent unequal motion, produced by the earth's revolving round the sun in an elliptical orbit, which causes alternately an acceleration and retardation of the sun's transit over a given meridian. If the earth had only a *diurnal* motion, any given meridian would revolve from the sun to the sun again in the same space of time as from

any star to the same star again, because it is evident that the sun would not change his place in respect to the stars.

The other causes which produce the equation, in addition to that of the earth's unequal motion in its orbit, are the *obliquity* of the ecliptic, and the *precession* of the equinoxial points. The equation of time is also affected, in a small degree, by the attractions of the planets; but the perturbations produced by the latter causes will make but little or no variation in the Examples already given.

The *mean* and *apparent* solar days are never equal, except when the sun's daily motion in right ascension is 59 minutes 8 seconds; which obtains about the 15th of April, 15th of June, 1st of September, and 24th of December; on which days the equation of time is nothing, or nearly so.

I have not had leisure to examine the Formulæ given by your correspondent "Vectis" (vol. ix. p. 326), for the reduction of the different kinds of time, taken, as he informs us, from "Kelly's Spherics," and which, it appears, have received *considerable alterations* from your correspondent! which being *admitted* to be correct, reminds me of the man who made a *mouse trap*, which, when completed, he was not able to set!!

In concluding, I may just remark, that the interval between *apparent* noon under two different meridians is one absolute space of time.

Suppose the difference in *mean* time to be 8 hours, the corresponding *sidereal* time will be 8 hours 1 minute 18·852 seconds; or the interval between the transits of a *fixed star* over the respective meridians, is equal to 7 hours 58 minutes 41·364 seconds of *mean* solar time.

Apparent time may be either greater or less than 8 hours, in proportion to the *daily variation* in the equation of time; but as *mean time* is its *common measure*, it must evidently be reduced to *mean time*, in order to obtain the longitude correctly.

Your correspondent (page 356) says that "there will be just the same difference between the variable or apparent times; for whatever be the rate of variation, it is *obviously* the same at *all places* in the same absolute instant." Now, as *apparent* noon does not take place under two meridians, differing from each other in longitude, at the *same instant* of time, the *variation* is *obviously* not the same at *all places;* for it has been shown in a former paper of mine on this subject, that on December 21, 1826, the daily variation was 30 seconds; and, consequently, as the equation is decreasing, the equation of time for a meridian 120 degrees West will be 10 seconds of time *less* than at Greenwich for *apparent* noon at each place. Your correspondent will please to recollect that *apparent* noon at Greenwich is not *apparent* noon under any other meridian.

"Vectis" also says (page 356), "Who that is the least acquainted with subjects of this nature could suppose the right ascension to be the same at the time of mean noon, under different meridians?" *And who, I would ask, that is the least acquainted with the above statement, would suppose the equation of time to be the same under different meridians?* For what purpose is the daily variation of the equation of time given in the "Nautical Almanac?"

As your correspondent has taken his leave of the subject, I can hardly expect an answer. I am sorry, however, that he has taken his leave of the subject under an impression of such erroneous ideas.

I am, Sir,
Yours, &c.
J. Utting.

Lynn Regis, July 7, 1828.

P. S.—*Dr. Brinkley's* computations were made for *apparent* time; but I am not aware that he states how it was obtained.

If the same equation of time were applied to both observations, the longitude deduced would be correct, as the interval would, in fact, be the same as in *mean* time.

'If *apparent* noon is computed from correct observations, the result ought to be the same as given by the Tables for a meridian differing from that of Greenwich; in which case the difference of *apparent* noon under the two meridians ought to be corrected by the *variation* of the equation of time, which reduces the *apparent* to *mean* time; and the longitude deduced therefrom is perfectly correct.

J. U.

CLOCK WITHOUT WHEELS.

Sir,—Being lately on a solitary ramble, with a Number of the Mechanics' Magazine in my hand (February 19, 1825), I perceived therein, for the first time, the desire expressed for a *clock without wheels*. Earlier than this, I had mused on the same subject, and rather wondered that it had not been attempted long ago. A thought struck me, that by the agency of a very *common substance* it might be obtained, without the aid of wheels, springs, pulleys, cylinders, liquids, or any chemical process whatever. I attempted such an instrument, and have kept it casually in play for about three years; the hours have an indicator, with a sonorous addition, and a light appendage, as an equalizer of gravitation. The progress, when collated with a common watch, generally accords with it. It operates many hours, days, and nights, at the option of the possessor; when the period chosen for its continuance approaches to cessation, a slight manual impulse, will instantly renew the whole process, and is the substitute for winding up.

Having conceited this rough scientific bagatelle (constructed in a few minutes), I but seldom gave it a thought, until I saw the number of February, 1825; and not having an opportunity of consulting the Numbers subsequent to February, 1825, I know not what remarks may have since taken place; yet, if this communication is not considered too trifling, I may hereafter be induced to go into particulars.

R. S.

[We are not aware of any thing in the Numbers of the Magazine, subsequent to that of 19th Feb. 1825, which would render superfluous an account of the machine invented by our correspondent, and shall be glad to hear from him again, with a drawing and description of it.—EDIT.]

WARMING CHURCHES.

Sir,—Perhaps some of your numerous correspondents could furnish me with a cheap and simple method of warming a church. It has been suggested, that it may be done by means of a flue under the aisle, similar to a hothouse; commencing with a common furnace grate at the one extremity of the church, and terminating at the other by a chimney; but as the flue would necessarily be perfectly horizontal, I am doubtful it would not answer the purpose, as the flues of hothouses are generally a little inclined upwards. The opinion of persons conversant with such matters, as well as any other suggestion, would much oblige,

Sir,

Your obedient Servant,

W. THOMAS.

Ross.

ANNUITY CASE.

Sir,—I shall be much obliged by the insertion of the following case in the "Mechanics' Magazine:"—

About two years ago an annuity was purchased for the *joint continuance* of the lives of two persons (both males), one of them aged 30, and the other 40; and in this year an annuity has been purchased for the same persons (their ages being, at the time of the latter purchase, 32 and 42), to continue as *long as either of them* shall live. The parties wish to know how many payments of each of the annuities it is probable they will receive. An answer from some correspondent of yours will be esteemed by

Your Constant Reader,

A. B. C.

THAMES TUNNEL.

Sir,—Your "Young Engineer" has not answered the questions I put to him, in the cool and candid style that he confesses I answered the questions he proposed to me; but turns round, and tells you that I was out of temper. I assure you, Sir, I was not out of temper with him, but was rather inclined to be merry on the subject.

The Thames Tunnel, he says, is deepest under the middle of the river. I think I can tell him the reason how it happens to be so. I think the original plan of the tunnel was to carry a three-feet arch from the engine shaft forward with the work, so much deeper than the bottom of the tunnel as would enable it to drain the deepest part, or middle of the tunnel—(I should suppose the "Young Engineer" would call that the kitten-hole in the farmer's barn door). Now, which would he prefer (if it was only for draining the tunnel for ever), my eight-feet drift, quite capacious and workman-like, or the above three-feet arch, that with great difficulty could be cleansed out when filled with the silt washing into it from day to day? Strange to say, that a three-feet arch is not deep enough to drain the end of the tunnel now, by 10 feet 6 inches; that is to say, the "Young Engineer's" kitten-hole is of no use, because, if the tunnel had not gone deeper than that three-feet arch would drain, the top of the tunnel would have gone out, (not quite as high as low water mark, but) most assuredly quite into the water. The engineer was, therefore, under the painful necessity *(for painful it must have been)* of taking the tunnel under the level of his intended three-feet drainage arch, or the tunnel must unavoidably have gone out into the Thames. How did such a mistake as the above happen? Was the depth of water in the Thames never ascertained previous to the commencement of the work? Why was not the depth of the shaft at Rotherhithe measured and compared with the depth of high water in the Thames, in the middle or deepest place? Those two depths, compared before the tunnel was commenced at the bottom of the shaft, would have shown in a moment that the top of the tunnel would go into the water in the deep parts of the river.

Now, Sir, if I am correct (as I have no guide but Mr. Brunel's first plans, and the reports which the public prints and your useful Magazine have, from time to time, furnished me with), the tunnel at present is 10 feet 6 inches under level of the drainage—how much deeper it will be necessary to go with it I know not. How is the water, caused by filtrations and other causes, when the tunnel is completed, (not noticing the trouble and expense of clearing the water after the eruptions, during the completion of the work,) to be taken from that trough in the middle, where it will lodge and accumulate, because of its being under drainage level? Is it to be carried away in buckets, or pumped by hand? I know a surface engine would pump it, but there must be pipes from the engine shaft to the middle of the tunnel to draw it by. Now, I would ask the "Young Engineer" if such make-shift, unworkmanlike jobs as the above, are to be compared to my eight-feet drift from the engine bottom, on my plan, to the deepest parts of the tunnel? I have no hesitation in saying, that the expense of raising the water up to the drainage level, for the past and future, in completing the tunnel only, will cost more money than the two shafts on my plan, including the expense of the eight-feet drift to the middle of the river.

I am aware, Sir, that the above is letting the cat and her kittens out of the bag; but as the "Young Engineer" has touched on that particular *(or I should not)*, I wish him to contradict me, if he can, and set me right. I assure him I by no means wish him to be drowned. What makes him think so?—(I might carry this joke a little further, but he would not forgive me if I did so.)

I am, Sir,

Yours, &c.

THO. DEAKIN.

Blaenavon, July 3, 1828.

PRESERVING SPECIMENS OF NATURAL HISTORY.

Sir,—Having noticed, in your excellent and amusing work (No. 236, p. 75), a mode to preserve specimens of natural history, a Subscriber will feel much pleasure should the following remarks be worthy of your notice:—

I think your correspondent "A. Z." will find less trouble if he places the bird or animal on its back, and makes an incision, according to its size, between the throat and the vent, *but carefully avoiding not to lay the skin entirely open from those points*. Proceed downwards to separate the skin from the flesh to the first joint of each leg; which, as he proposes, must be there separated. In this stage there will be no difficulty in cutting off from the body the tail of a bird, or skinning that of an animal, and turning the skin over the vent. Then attach a suspended hook to the body, and draw the skin entirely off, down to the head; the wings or fore legs having been cut at the first joint, in the manner prescribed. The trunk and neck must now be removed, and the brains, eyes, &c. taken out. Then rub the skin and skull with the following composition:—Arsenic, 2 oz.; white soap, 1½ oz.; lime, ½ oz.; mixed over the fire with water, to the consistence of a thin pomatum; dissolve gum camphor 1 dram, and sal ammoniac 2 drams, in a little spirits of wine, and add it to the above when cool. Should the preservative, having been made some time, harden, a little hot water will render it fit for use again. Then turn the skin the right way, and proceed to bind a piece of wire, with tow or herds, to the size of the body of the bird; or if an animal, the tow must be cut small, and put in loose; run the wire up the throat, and bring it out at the skull (where it must be cut close, and covered by the feathers or hair), drawing the skin over the herds: the other end will support the tail. The legs and wings will have other wires, the ends of which may be twisted round the principal one with the forceps, instead of fixed in the cork, as proposed by "A. Z.," and then cut off at proper lengths.

The motive which induces me to forward the above short account, is its being the plan adopted by a friend, whose stuffed birds and animals excite universal admiration. And I trust that "A. Z." will find convenience, from the skin not being cut in two at the breast, as it will give him an opportunity of filling it out with small portions of herds passed down the throat by means of a thin piece of whalebone, to any size, and avoid that *flatness* which is so generally seen in preserved birds. The receipt above given will save both time and trouble, and effectually destroy all insects or eggs which may be deposited in the skin. It is but little known, and of the greatest value for the preservation of specimens of natural history.

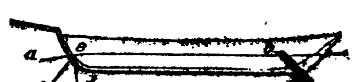
I am, Sir,
Yours, &c.
F. X.

[We have received a very complete and valuable set of instructions on the same subject, from "E. J. M., of Bradford;" but as they are of considerable length, we have deferred commencing the insertion of them till we enter upon a new volume.—EDIT.]

TOWING BOATS.

Sir,—The following contrivances, it appears to me, would prevent boats from being towed under water by vessels (particularly steam packets), as frequently is the case at present. If you think them worthy of a place in your valuable work, their insertion will oblige

Your obedient Servant,
A YOUNG NAVIGATOR.
Waterford, May 9, 1828.

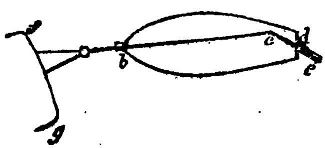


Supposing a b to be the water-line

on a boat in tow, when the vessel goes at a great velocity; the water striking the boat's bow in the direction *a e*, is reflected from it in the direction *e d*. From thus making the angle of reflection equal to the angle of incidence, it has a tendency to push the boat's bow in the direction *c e*, which raises it out of the water in proportion to the rate of her movement through it. But as there must be a certain proportion of every floating body (in proportion to its specific gravity) under water, therefore, as her bow is raised so must her stern sink; therefore, at a certain velocity, her stern will sink until the water flows in and swamps her.

Now, to obviate this, I propose to have a moveable board *b h*, to hook on her stern, that the water may meet an equal resistance at the stem and stern, and have an equal tendency to raise both, so that the greater the rate at which she would be towed, the higher she would be raised out of the water.

It has also struck me that a more economical and certain mode of steering a boat in tow of a vessel, than having a man stationed in her, is practicable; and in the following plan the act of sheering from side to side will turn the rudder so as to counteract it.



f g is the stern of the vessel.
b d the boat in tow.

a e a pole, turning on a swivel at *b*, the bow of the boat, and having a ring at *a* for the painter, and another swivel at *c*, connecting it with the tiller *c d*.

The operation of this must be evident to every one, without farther description.

MISCELLANEOUS NOTICES.

Do Insects feel Pain?—The cruelty of collectors in tormenting insects is often a theme of reproach; but it is not difficult to adduce numerous facts, proving that the converse of our great poet's conclusion,—

> "The poor beetle that we tread upon,
> In corporal sufferance, feels a pang as great
> As when a giant dies,"—

must be nearer the truth. A humble bee, for example, will eat honey with greediness, although deprived of its abdomen; and an ant will walk when deprived of its head. The cockchafer will walk about with all indifference, when its bowels have been scooped out by birds; and the dragon fly or horse-stinger will eat insects which are offered to it, after it has been stuck upon a pin. The various species of father-long-legs fly about after losing their legs, as agile and unconcerned as if nothing had happened. It is probable, indeed, that acute pain, such as we ourselves are acquainted with, can only be felt by animals furnished with warm blood and with a brain and spinal cord.—*Athenæum.*

Meeting a single Magpie.—There are many superstitions of the vulgar, owing to the same source (observation of the instincts of birds). For anglers, in spring, it is always unlucky to see single magpies, but two may be always regarded as a favourable omen; and the reason is, that in cold and stormy weather, one magpie alone leaves the nest in search of food, the other remaining sitting upon the eggs or the young ones; but when two go out together, it is only when the weather is warm and mild, and favourable for fishing.—*Sir Humphry Davy's Salmonia.*

Immense Cannon.—In the Kremlin at Moscow, there is a cannon of enormous size. It was cast by order of Prince Theodore Iwanowitsch, in 1586, in the third year of his reign, by a Russian of the name of Andreas Tschashoff, whose name can still be read upon it. This cannon weighs 96,000 pounds. It will carry a ball, weighing 4800 pounds; to do which it requires a charge of 1600 pounds of powder.—The *Lemberg Gazette,* from which we take the above account, gravely adds, that "though it remains unguarded, no one has hitherto attempted to steal it" But Gazetteers have sometimes strange notions of things. It is not long since one of our own country informed his readers, that some *light-fingered* gentry had, in the night time, robbed a poor waggoner of his *horse and cart!*

Etching Ground.—Take two ounces of asphaltum, two ounces of virgin wax, half an ounce of burgundy pitch, and half an ounce of common pitch. Let all the articles be procured clean and good; let the three last be melted first, and the asphaltum be pounded and sifted through a lawn sieve, and then put to them; then boil the whole till properly mixed, which may be known by putting a stick in and drawing it out, for if not mixed, the asphaltum will be seen in shining particles.—T. V.

Youthful Ingenuity.—A young gentleman, a native of this place, has printed several copies of an 18mo. work, extending to nearly 70 pages. He made the whole of the types with his own hand, and with the assistance of no other implement than a penknife. He also constructed the press with which the work was printed, and manufactured his own ink. What is perhaps as singular is, that he composed, corrected, and printed the whole impression with his own hand, without ever having received the slightest direction from any individual, or ever having seen a printing establishment, or anything belonging to it.—*Elgin Courier.*

Safety Lamp.—A Mr. Dillon has devised an improvement in the safety lamp, which will, it is

hoped, render it more efficient than it has hitherto been found. He has been led, by a number of experiments, to conclude that it derives its power, not as Sir H. Davy supposes, from any property which wire gauze possesses of cooling or extinguishing flame, but from the heat of the lamp so rarefying the surrounding air, that this rarefied air prevents that accession of oxygen from the external atmosphere, which is necessary to the spreading of the flame. He proposes, therefore, to increase the heat of the lamp by additional burners, and to have a semicircular shield of talc to protect it from being affected by any cooling currents of air. D. F.—We do not set much value either on this new theory or improvement; judging of them, at least, from the account here given. The experiments of M. Libri, of which a report was given in our 8th vol. p. 229, appeared to us to have satisfactorily established that the operation of the safety lamp is owing to a repulsive effect of the wires of the gauze tissue. If such be the case, Mr. Dillon's improvement can of course have no applicability; his theory, at any rate, is entirely fanciful.—*Edit.*

MINOR CORRESPONDENCE.

Geometrical Nomenclature.—Some reform in the terms used to designate the different sorts of curves would appear, from the communications of our esteemed correspondents Mr. Jopling and "F.," to be very necessary. The latter states, in a note which we have received from him, that in our translation of his paper, in No. 253, we have erroneously employed the term *cycloid* as synonymous with the French word *roulette*, inasmuch as "roulette is the generic term consecrated by La Hire and Nicole, and the word cycloid is only descriptive of a particular case (of the roulette); and it might be inferred that he ('F.') confounded the general with the ordinary cycloid." We perceive the force of the distinction drawn by "F.;" still, it is certain that no such distinction has been hitherto generally observed—among English geometers at least. Dr. Hutton, in his Biographical Notice of Pascal, says,—"He discovered the solution of a problem, proposed by Mersenne, which had baffled the penetration of all that had attempted it. This problem was, to determine the curve described in the air by the nave of a coach-wheel, while the machine is in motion; *which curve was thence called a roulette, but now commonly known by the name of cycloid.*"—(Dict. vol. ii. p. 203.) It seems probable, however, that had we adhered to the term *roulette*, as used by "F." in his paper in No. 253, the observations made upon that paper by Mr. Jopling, in our present Number, would have undergone considerable modification; and we have little doubt that, by restoring the use of it, a good deal of misconception may be in future avoided.

Litmus Turmeric Papers.—Sir,—By your giving some account of the method of making litmus and turmeric papers, you would confer an obligation on many persons who, like myself, are often using them, as tests for alkalies and acids, &c., but find it inconvenient to send to London to procure them ready made. I am, &c., W. T. (A Country Reader.)—Test papers are made simply by spreading over them an infusion of litmus, turmeric, or any other colouring vegetable, and then setting them to dry; or by keeping the vegetable extract in a fluid state, and dipping the paper into it as it is wanted to be employed.—*Edit.*

The "pure animal oil, for clocks, guns, &c.," about which "Ben" makes inquiry, is prepared by a person of the name of Perigo, and was stated by the correspondent who brought it under the notice of our readers (vol. vii. p. 255), to be sold by Lang, Haymarket. Reference on the subject was also made to Mr. Purdy, gunmaker, 4, Prince's-street, Leicester-square.

NEW PATENTS.

Edmond Gibson Atherley, of York-place, Portman-square, Esq., for a method of generating power, applicable to various purposes.—12 June—6 months.

William Stratchan, of Avon Eitha, Denbighshire, for an improvement in manufacturing alum.—12 June—4 months.

George Johnson Young, of Newcastle-upon-Tyne, iron-founder, for a machine, whereby an additional and improved purchase or power will be given in working ships, windlasses, and capstans.—21 June—6 months.

Samuel Pratt, of New Bond-street, London, camp equipage maker, for certain improvements on elastic beds and cushions, seats, pads, and other articles of that kind.—25 June—6 months.

INTERIM NOTICE.

The present Number completes our Ninth Volume. On Saturday, the 16th of August, the Supplement, containing Titles, Preface, and Index, with an original Portrait, engraved in the same superior style as that of the King, of His Royal Highness the Duke of Sussex, will be ready.

We were desirous of bringing every thing which has been matter of debate, in the course of the present volume, to a conclusion, before we entered on another, but there are still two or three subjects which must unavoidably stand over for future discussion. We have to mention in particular, the controversy as to "the Knowledge of the Ancients," the originator of which, Mr. Dubois, is unfortunately prevented by ill health, and removal to a distant climate, from being as prompt in maintaining his side of the question, as he has doubtless every inclination to be. His opponent has found, in the meanwhile, an able auxiliary in "Mentor," to whose paper we propose to give early insertion.

The papers of the grandson of the celebrated Harrison have been purposely kept back, for two or three weeks, that they might appear consecutively in the same volume. We shall give the first next week.

"S. C." will find his recommendation attended to in the Supplement to Vol. ix.

"C A. B.'s" letter (so unnecessarily crossed and delayed in its progress), came too late to hand to be included among the articles on the same subject in this week's Number, but shall have our earliest attention.

Communications received from S. Y.—A Practical Querist—A Traveller—Anglicus—M. C.—F.—Watchman—Rus-Astro—A Constant Reader—Philobrune—John Thomas—D. H. N.—Julius—One who Wishes you Well—J. Spence—Aristides—Hammercloth—B. Z.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster Row, London.

END OF VOL. IX.

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INDEX TO VOL. IX.

LIST OF ERRATA TO VOL. IX.

Page 24, col. 2, line 6 from the bottom, for "Tredgold," read "Telford."
—— 39, — 2, for the diagram there given, substitute that in p. 235.
—— 50, — 1, line 31, for "far," read "they."
—— 142, — 2, — 47, for "*two* journeymen," read "*the* journeymen."
—— 156, — 1, — 8, for "Repository of Arts," read "Repertory of Arts."
—— ib. — 2, — 22, for "half-burnt cock," read "half-burnt cork."
—— 158, — 2, — 24, for "superior," read "inferior."
—— 236, — 2, — 8 from the bottom, and also in bottom line, for "No. 231," read "No. 232."
—— 240, in last article of Minor Correspondence, for "not till something farther is known concerning it. The discussion," &c. read "until something farther is known concerning it, the discussion," &c.
In the page following p. 330, for "231," read "331."
—— 328, col. 1, last line, for "P. C." read "J. J."
—— 353, in Motto, for "mine," read "mind."
—— 394, col. 1, line 2, for "Mr. Jopling," read "F."
—— 398, — 1, — 10, for "exactly a straight," read "exactly straight."
—— 417, — 1, — 4, for "exclusively," read "extensively."
—— 423, — 1, between lines 39 and 40, insert "the Tables requisite to be used with."
—— 448, — 2, — 14, for "Stratchan," for "Strachan."